The Glass Industry
REG. U. S. PAT. OFF.

Vol. 9 JUNE, 1928 No. 6

Density Control of Glass Tanks

By A. R. Payne[1]

Introduction

A prerequisite for the satisfactory and efficient operation of glass tanks is glass that is uniform from hour to hour and day to day over long periods of time. An operator likes to know that only such changes occur in the physical and chemical properties of the glass as he intentionally brings about by altering the composition or varying the melting technique.

Unfortunately, raw materials and melting conditions are prone to unexpected changes or the human element will momentarily relax and a mistake will occur which will change the uniformity of the glass into a most disconcerting heterogeneity.

With instruments to show tank temperatures, draft, etc, it is possible to control melting conditions so that in general a uniformity of the product is assured. But at times the composition changes, in spite of all precautions. In that case the density is a good key to the composition and to the other physical properties which the glassmaker strives to regulate and hold constant.

With well melted, well annealed glass we have found that

(a) If the density of the glass changes, the composition of the glass has changed.

(b) If the composition changes, the density will almost invariably change.

(c) When the glass has been running good and the density has been fairly constant, any sudden change in the density indicates a variation in the glass-making technique and presages trouble.

(d) A day to day check on the density of the glass is a good index of the uniformity of the metal and the plant practice which produced it. A complete chemical analysis would give the same information but could not be completed in time to be as useful in finding the trouble and adopting remedial measures.

Factors governing the density of glass:

COMPOSITION.

For every kind of glass we have different proportions of the glass-making oxides present. As these proportions change the density of the glass changes. Winkelmann and Schott used the formula

$$\frac{Z_1}{X_1} + \frac{Z_2}{X_2} + \frac{Z_3}{X_3} + \frac{Z_4}{X_4} = \frac{100}{S}$$

where S is the density of the glass, Z_1, Z_2, Z_3, the percentages of the oxides present, and X_1, X_2, X_3, are the densities of the oxides in the combined state. These densities of the oxides in the combined state are the product of the true density of the oxide and a constant which depends on the oxide itself. The name "density factor" is given to the value of the density of the oxide in the combined state. These density factors are determined by taking a large number of glasses, analyzing them and determining the densities and trying to find values for X_1, X_2, which will fit in the above equation for the greatest number of glasses. The following table gives the density factors proposed by different investigators.

Table No. 1

TABLE OF DENSITY FACTORS

	SiO_2	CaO	MgO	Na_2O	Al_2O_3
Winkelmann and Schott	2.3	3.3	3.8	2.6	4.1
Tillotson	2.3	4.1	4.0	2.8	2.75
Baillie	2.24	4.30	3.25	3.20	2.75
English and Turner	2.20	3.30	3.38	3.47	2.75

The additive effect of the specific volumes of the various oxides as minor changes occur in the composition depends altogether on the total quantity of each oxide present before and after the proposed change.

It is my belief that it would be absolutely impossible to work out a set of factors in the manner proposed by Winkelmann and Schott and others that will give accurate results irrespective of the kind of glass being made. It is only when we consider one particular type of glass containing a very few oxides and vary the proportions a per cent or two that we can get a set of factors that will work at all satisfactorily.

For the particular type of glass whose analyses are given

[1] Fostoria Glass Company, Moundsville, W. Va.

in Table 6, the following set of density factors give fairly concordant results.

Table No. 2

SiO_2	2.34	MgO	3.84
CaO	2.94	Al_2O_3	3.48
Na_2O	2.96		

When the various density factors are used in calculating the density we have

Table No. 3

GLASS NO.	DENSITY (OBSERVED)	DENSITY (CALCULATED)				
		1.	2.	3.	4.	5.
1—A	2.4910	2.439	2.49	2.49	2.485	2.49
2—A	2.4432	2.40	2.44	2.43	2.418	2.45
3—A	2.4722	2.42	2.47	2.46	2.44	2.475

In this table the results under Density (calculated) are obtained from using the density factors proposed by (1) Winkelmann and Schott. (2) Values proposed by Tillotson. (3) Values proposed by Baillee. (4) Values proposed by English and Turner, (using 4.2 for CaO). (5) Values suggested by the author for glass of this general type.

For computing the density of any glass differing from those used in this computation even to the extent of substituting MgO for part of the CaO we will have to use different factors. Eventually every chemist will use a private set of factors suitable for his particular glass. These factors will not be determined without plenty of work and many analyses.

Non-Homogeneity

When batch is being conveyed from the mixer to the tank there is always danger that segregation may occur. When the mixed batch falls into the storage bin, usually located above the dog house of the tank, more segregation follows. Since the growing popularity of limestone, coarse in comparison with the other ingredients, this condition is more common. Proper attention to the design of the storage tank and the grain size of the batch ingredients will eliminate these causes of segregation.

There are certain well known rules for operating glass tanks that are generally recognized if well melted cord free glass is desired. Among others, the following are important.

1. Avoid hot and cold spots on the surface of the glass.
2. Keep heating value of all gaseous fuel well up.
3. Keep tank "pull" fairly constant and not too great.
4. Avoid running the tank at too low a temperature for the "pull."
5. Keep the condition and quality of the fire about constant.

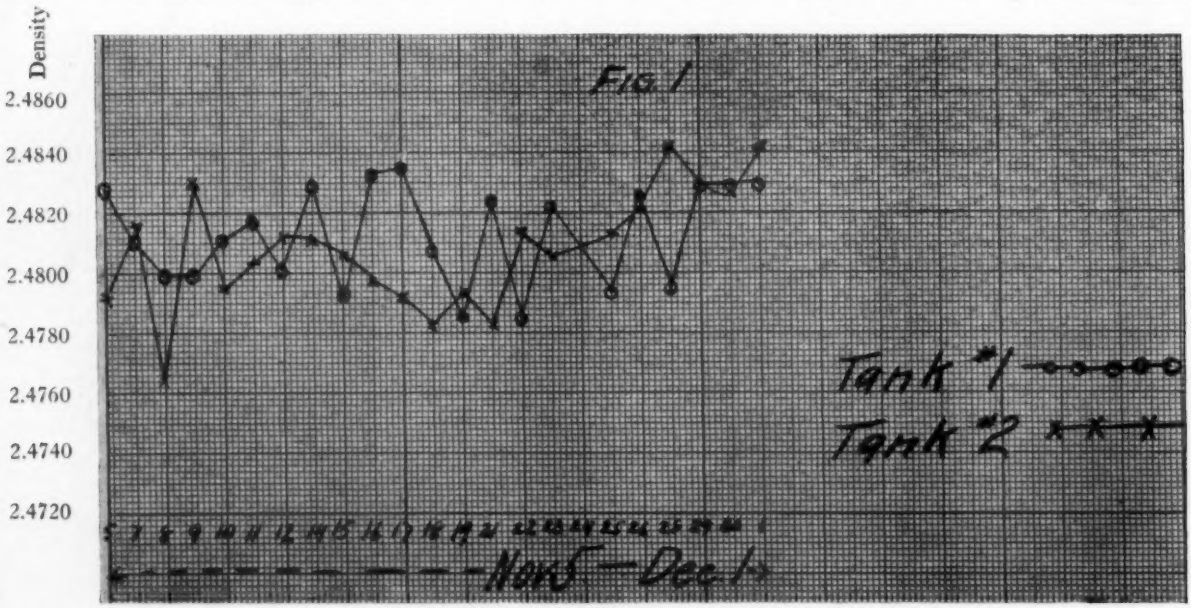
If segregation occurs or if the furnace conditions get "off," non-homogeneous glass results and cords are an ensuing evil whose presence is forecast and accompanied by erratic densities of the glass.

If the furnace conditions are O.K. and cords cannot be traced to segregation, it is possible that it is the changing composition that is responsible for the varying density.

When foreign material is present or if the glass has seeds, stones or blisters, it is obvious that the density of the glass will not be constant. When tests are made on such glass, care must be taken to select samples free from these defects. It is doubtful whether density tests are of any value in overcoming these troubles.

When dissolved gases are present in their usual proportions they increase the density slightly over that of gas free glass. Still, it is the author's opinion that these proportions are usually so uniform that from any one tank the variations in density of the glass from that source are negligible.

In the same manner, the material from the tank blocks that dissolves in the glass will reach a given amount and then under ordinary running conditions where the tank pull is fairly constant it will remain about the same. When a tank is new there will be a slightly greater density of the glass than when it is older. This is due to the fact that the greatest amount of Al_2O_3 is dissolved from the walls during



the first month and successively decreasing amounts during subsequent months.

It is not as common now as it was in the old days for scales to become "off." But it still happens and scales should be checked at regular intervals. Test weights as part of standard equipment are not rare and better scales are becoming the rule.

At times the scales have been all right but the man at the wheel has failed. I know of one tank where for some time the quantities of sand and soda entering the batch were reversed. In that case there was no need for a very delicate test to find trouble.

But in many cases little unexpected errors will creep in through carelessness or neglect and the glass will gradually change its composition and physical properties until it becomes impossible to use it. If lime is used non-uniform burning may give from 3-25 per cent ignition loss. Sand containing moisture or old caked soda ash have all been causes of such trouble. Any variation in the proportions of glass-making oxides in the raw materials will change the utimate composition of the glass and its physical properties.

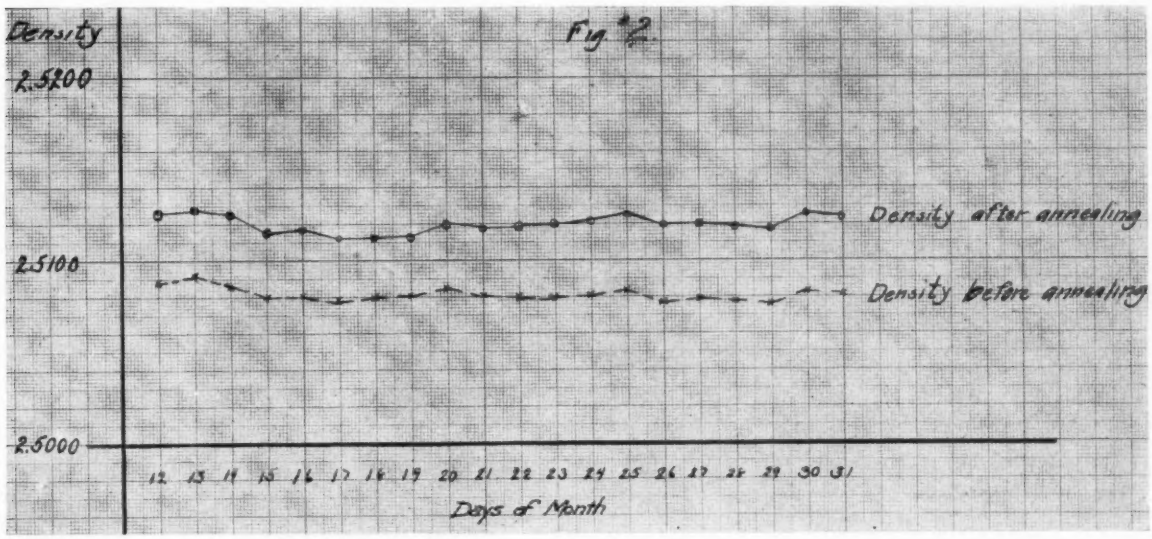
Effect of Heat Treatment and Pressure

An unannealed or a poorly annealed piece of glass will have a lower density than a well annealed sample. This is due to the fact that in a well-annealed sample all parts cool so evenly that the outside surfaces do not become chilled and set while the interior is still hot and expanded. When such a chilling and setting occurs, the final bulk is greater and consequently the density is less.

Fig. 2 shows the well-nigh constant difference between ordinary lehr annealed and well annealed ware over a month's run.

In practice, when density samples are being chosen and prepared it is advisable to take all samples from some part of the article where the annealing is practically uniform (such as the neck of the bottle) or to reanneal all samples by a carefully selected schedule. The latter method is more accurate as in that way all variations in density due to imperfect annealing are rendered so small as to be negligible.

It is probable that there are slight changes in density due to the enormous pressures used in forming tumblers and similar ware on modern high speed automatic machines. Pressures as high as 5,000 pounds per square inch are used and the plastic glass at times becomes slightly more dense as a consequence. At the same time a strain is established that is almost impossible to remove by ordinary annealing; an actual remelting of the glass being necessary to restore normal conditions. However, since all the articles being made from a single tank are usually made in the same manner it is possible to get comparative results from daily density tests as the effect of the high pressure is common to all and introduces a constant error.



It is easy to see that density results from one tank cannot be compared with those from another tank where different operating or manufacturing methods are used. The tests from each tank stand by themselves and it is when there are variations from normality that future troubles are indicated.

Variations in Density. In Different Parts of the Same Tank

The following table is given to illustrate the variations in density of the glass that may occur in a tank. These samples were taken from the tank after the glass had cooled "in situ."

Table No. 4

	Position in the Tank	Density
1.	ft. below surface, 4 ft. from r.w.¢.m.e.	2.4480
2.	From bottom, 4 ft. from r.w.¢.m.e.	2.4479
3.	From bottom, 4 ft. from l.w.¢.m.e.	2.4508
4.	From bottom, 3 ft. from bridge, ¢.m.e.	2.4498
5.	From surface, 4 ft. from l.w.¢.m.e.	2.4497
6.	From 1 ft. below surface, 4 ft. from l.w.¢.m.e.	2.4515
7.	From surface, 3 ft. from bridge, ¢.m.e.	2.4474
8.	From surface, 4 ft. from r.w.¢.m.e.	2.4497
9.	From 1 ft. below surface, 3 ft. from bridge, ¢.m.e.	2.4492

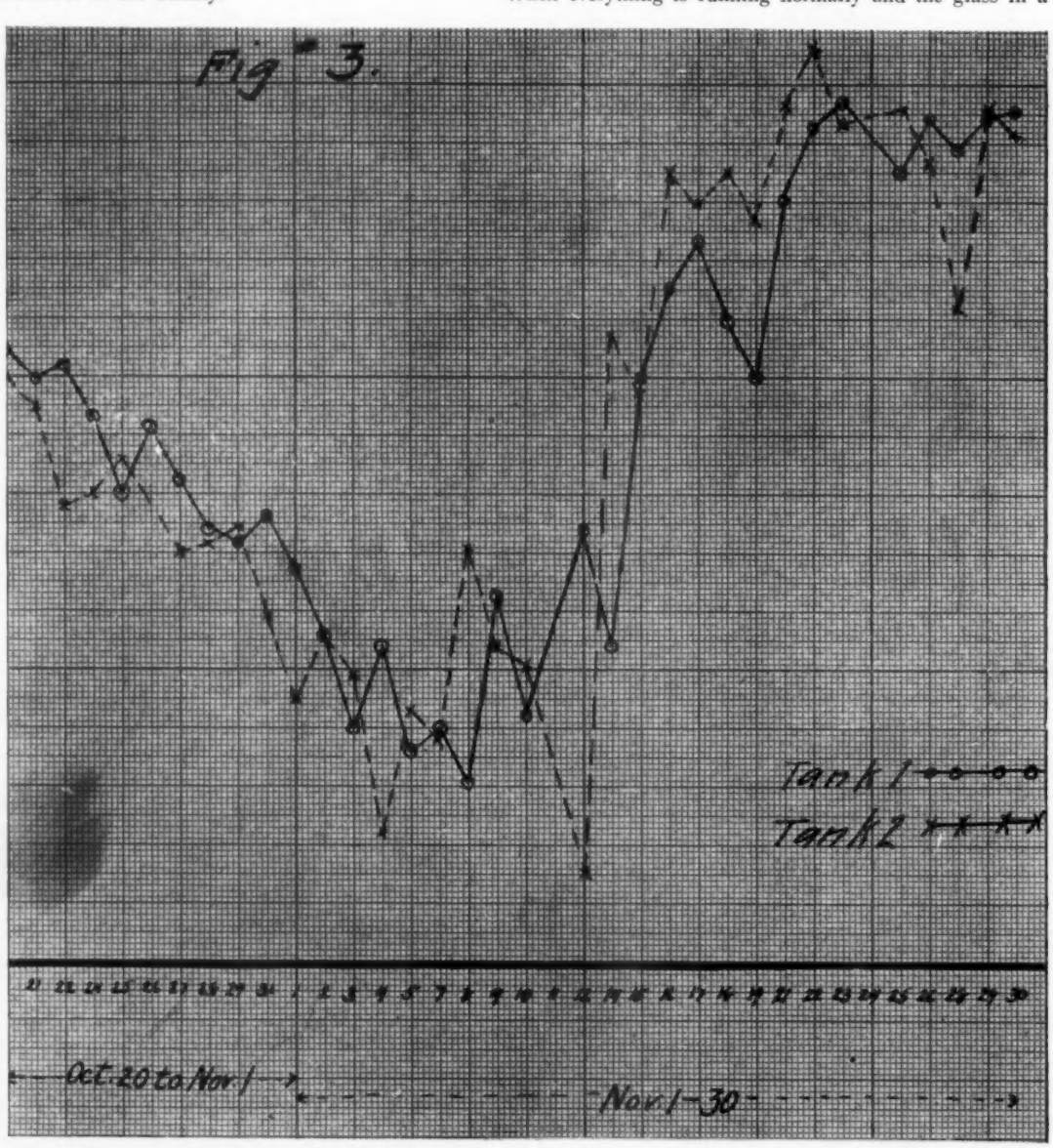
r.w.—right wall.
l.w.—left wall.
c.m.e.—on longitudinal center of melting end.
¢.m.e.—on latitudinal center of melting end.

As will be seen, these results indicate a fairly even density throughout the tank. There is a region along the left side which is slightly higher than the remainder. Later we will see how much difference in composition is necessary to make that much difference in the density.

It saves time to take a fragment from each of the eight articles being made and get the density of the combined sample. The value so obtained is practically the same as though run separately and the average taken.

When everything is running normally and the glass in a given tank is good, the density record from that tank may be represented by a fairly straight horizontal line on a graph. If the factors that affect the density are so under control, that one variable only (the composition) is a probable cause of change, that one variable can be arbitrarily altered so that the composition will be corrected and the density record brought back nearer to a horizontal straight line when it has deviated upward or downward.

For example, assume that the burned lime used in the manufacture of a glass is partially burned or is somewhat air-slaked. If the lime in use on a particular day should have a higher ignition loss than on a previous day, less calcium oxide will get into the glass and the density will drop.



Sometimes a sample of the glass taken from a single flowspout has a density that is not representative of the whole tank. To guard against this it is customary to take a sample of the glass coming from each flowspout.

Table 5 shows how much variation may be expected if each sample were considered separately.

Table No. 5

Flowspout	Density	Flowspout	Density
1.	2.4471	5.	2.4493
2.	2.4486	6.	2.4500
3.	2.4484	7.	2.4475
4.	2.4495	8.	2,4482
Average Density			2.4486

Such a change would be evident less than eighteen hours after the batch entered the tank and it would be a simple matter to raise the lime slightly after noting the tendency of the density record to drop.

This method of density control was started by the author in 1920 and for years it was successfully used in four large glass factories making general lines of tank glass.

This method of density control was checked at regular intervals by chemical analyses. In only two cases in seven years did we find a change in composition that was not accompanied by a corresponding change in density. In those two cases the lime content dropped about half the amount that the soda content increased. This simultaneous decrease of the lime and silica and increase of soda exactly neutralized each other and the density remained the same.

As an example of the way in which the composition of the glass changes in an uncontrolled tank the following case is cited. The three samples 1A, 2A, and 3A were all from the same tank and supposedly the same batch was used.

Table No. 6

FACTORY X. TANK NO. 1.

	Lab. No. 1A	No. 2A	No. 3A
Date	3/23/21	8/27/21	10/5/21
Density	2.4910	2.4432	2.4722
SiO_2	73.75%	77.02%	74.91%
R_2O_3	.67	.58	.70
CaO	9.25	6.81	7.11
MgO	.63	.46	.46
Na_2O	15.06	15.30	16.35

Here we have a case where density control would have kept the composition within reasonable limits and the uniformity of the glass would have been maintained.

As a matter of fact, shortly after sample 3-A was made, density control was inaugurated in that Factory X and worked very well. During the first month after its installation the density from the two tanks in operation ran as shown in Fig. 1. This graph shows greater variation from day to day than is desirable.

It is not possible to get as uniform glass from a tumbler or bottle tank as it is where sheet or plate glass is being made. Consequently a better density record is gotten with the flat glass. Such a record is shown in Fig. 2. This record shows about the best obtainable results from tank control.

An interesting example of extremely poor tank operation is shown in Fig 3, where the density records for two of the uncontrolled furnaces in Factory K are given for a forty day period. This record shows how the density changes when the silica content of the glass shifts two or three per cent within a few days.

It is usual for the densities to be determined at the factory although at times the samples have been sent daily to a central laboratory. With proper precautions and equipment it is possible to obtain the density with an accuracy of one part in 20,000. One operator can repeat his work with that degree of precision. Five densities can be determined in two hours, including the selection and preparation of the samples and the computation of the density. Corrections for the expansivity of the glass and the temperature of the water being used must be made.

In conclusion, the author wishes it to be understood that this method of density control was used to supplement chemical analysis, not to supplant it. It was found helpful in control work, but there are many points about its nature and use where further research is desirable.

Greatest Glass Producing County in England

Early in the year at a joint meeting of the Society of Glass Technology and the Manchester (England) branch of the Geographical Association held in the Geographical Lecture Hall, Manchester, a lecture, "The Glass Industry of Lancashire" was given by L. Milner Butterworth of Butterworth Bros., Ltd., Newton Heath Glass Works.

Mr. Butterworth, who is a Fellow of the Royal Geographical Society, said that it was perhaps not generally known that Lancashire is probably the greatest glass producing county in England. In Manchester both fine tableware and industrial glass is produced; in St. Helens, which has been called "one of the chief centers of the glass industry of the world" sheet and plate glass and bottles are made; and in Liverpool, Preston and Warrington are to be found the manufacture of bottles, electric bulbs and table glass respectively. One firm alone at St. Helens now employs over 12,000 people, but nevertheless Lancashire glass industry is of comparative recent growth.

For some time the plate glass wind screens used on the Ford motor cars were supplied from St. Helens. These were shipped to the great Ford works in Detroit. The wind screens continued to be supplied from Lancashire until Henry Ford built his own glass works.

The making of electric bulbs is an industry of which Preston is a center, and has grown to an enormous extent during the past twenty years. Up to the end of the great war, hand methods of production were used in this country, but during the last decade an automatic bulb blowing machine has been introduced from the United States. This Westlake machine, nicknamed the "iron man" on account of the life like action of its arms, is capable of turning out a thousand bulbs an hour.

A wide range of glassware is produced in Manchester, one firm in the city being the only concern in England that manufactures fine table glass in addition to all kinds of glass for mechanical, scientific and industrial purposes.

Taking Lancashire as a whole therefore, we find that the two chief centers for the glass industry within the county boundaries are St. Helens, where over one hundred thousand tons of sheet and plate glass are produced each year, and where each week thousands of grosses of bottles are made, and Manchester, where a greater variety of glass is manufactured than in any other city in the country, not even excluding London.

No account of any section of the English glass trade would be complete without an acknowledgment of the immense debt the industry owes to Professor W. E. S. Turner of the University of Sheffield, who created the Department of Glass Technology of the Sheffield University.

The Flow of Glass in Tanks

By S. R. Scholes[1]

IN rating the tonnage drawn from a glass tank, the expression in general use is the number of square feet of melting area per ton drawn. Where the tank is 40 inches deep, each square foot of melting area corresponds to 3⅓ cubic feet of glass, weighing 500 lbs. Standard practice in tanks of the conventional type in use for bottles and other hollow ware allows 10 square feet melting area per ton of glass drawn per day. With the glass 40 inches deep, this means 5,000 lbs. or 2½ tons of glass present in the melter, for each ton drawn through the throat. On the average, therefore, the glass remains in the melter 2½ days.

It seems obvious that this time is longer than should be necessary to plain off the glass in a tank. In fact, in pot-operation, 1½ days is all the time required, in a moderately hot furnace, to plain off the glass in a pot. The temperature of pot-interiors cannot be accurately known, but is probably around 2550 deg. F. while tanks run at the pull described above are usually near 2700 deg. F. Thus it appears that, in spite of direct fire heating and higher temperatures, it takes longer for the average tank glass to be plained than if it were melted in pots. This circumstance works against the fuel economy of the tank-furnace, and the reasons and the remedy for it should be sought.

The chief reason for the relative slowness of the tank process may be found, in the writer's opinion, in the manner in which the glass flows through the melting chamber, from charging end to throat. We shall consider this flow, using the facts available, and reasoning from the physical properties of the raw batch and cold cullet, and molten glass resulting from the heating process.

When the residual glass is removed from a cold tank at the end of a fire, there is found a dark, brownish-green layer, varying in depth from 6 to 12 inches, covering most of the bottom of the melting end. Meanwhile, up to the time it was let out of service, the tank has been producing glass of good color, at least free from such streaks and cords as would be caused by the movement of the dark layer through the throat into the working end. This dark layer has been stationary. It makes up about 15 per cent of the contents of the melting chamber.

While no such dark glass can be found at higher levels in the corners of the tank, there is reason in the belief that here, also, the glass is relatively stagnant. As in a river the water flows more slowly near the banks than it does in the middle of the stream, so in a tank it must be expected that the molten glass near the sides and in the corners would be slowed in its movement. It may safely be estimated that this retardation has the same effect as though an added 10 per cent of the glass did not move.

A third factor producing inequality of flow between various parts of the glass stream is the temperature gradient between top and bottom. In the absence of reliable data, we can only guess at the rate temperature falls through the depth of a tank-full of glass. That it does fall, may be accepted without question. And in a viscous liquid like glass, whose fluidity falls off rapidly with decrease of temperature, the result of a relatively small degree of cooling would be to change to a marked extent the relative velocity of flow.

That is to say, as glass is drawn from the working end

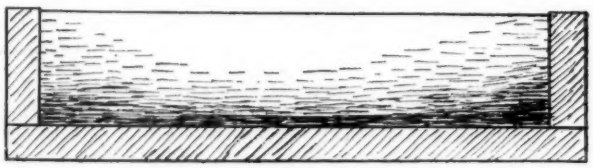


FIG. 1

and added in the form of batch and cullet at the back of the melter the movement taking place to equalize level must be restricted to a considerable extent to the upper and central portion of the glass mass.

Fig. 1 is an attempt to picture the relative degrees of stagnation, and represents a transverse section of the melting chamber, midway of its length. The unshaded portion shows the hottest and most freely moving glass, and the depth of shading indicates the extent to which flow is retarded.

A more complex problem is presented, when we consider the behavior of melting batch and cullet. Here we have two opposing tendencies: one is a sinking of the new-melted material because it is cooler and therefore specifically heavier than the bath; the other is a buoyant action, due to the evolved gases, which tend to lift the new glass and keep it near the surface.

We are sometimes able to observe, from the character of the glass in the working end, where cullet charged in large pieces has sunk away from the remainder of the charge and formed a persistent layer underneath. On the other hand, we more often see the balls or floating islands of new material journey half-way down the tank before disappearing.

Apparently no simple mode of behavior can be set forth, describing the progress of new material as it melts and as the gas-bubbles generated during the melt rise from it. Perhaps enough has been said to suggest that it moves "over, under, around, and through" the older glass of the bath. Some of it may remain in the tank for days, and some of it may reach the throat and pass into the working end within a half-day after being charged. It is this last-named portion which, by overtaking older glass and passing through out of its turn, limits the tonnage of the tank or even gives rise to seedy glass.

It would be pleasant to believe that the glass in the melting chamber, or a large part of it, moved regularly from dog-house or batch-charger to throat. That it displaced the glass ahead of it. That at any given time the back one-third of the melter contained yesterday's fill exclusively, while at the throat could be found only glass at least two days heated. But anyone who has watched color or composition changes

[1] Federal Glass Company, Columbus, Ohio.

knows that first effects, in the conventional type of tank, occur sooner than we expect them, but that the completion of the changes is a gradual process. This is conclusive evidence of the eddying and mixing that goes on as new material is added to the bath. The limited experience that has been had with the new tanks in which the melting chamber is of the trough or channel type, much narrower in proportion to its length, points to a different behavior during the melting process. In such tanks, the flow of the glass seems to involve more equally the entire contents of the tank. Consequently, although the depth of glass in these trough-type tanks is often only 18 inches instead of 42 inches, it has been found possible to draw one ton of glass from each 10 square feet of melting area.

It will be noted that here the amount of glass in the melter for each ton drawn, at a depth of 18 inches, is $\frac{10 \times 1.5 \times 150}{2000} = 1.12$. That is, the glass remains in the melting chamber only a little more than one day. If we allow an inch or two below the block height for the actual glass level, as indeed the usual practice requires, the calculation comes out almost exactly ton for ton.

Several forms of these tanks have been devised. They differ essentially in the manner of firing and of getting the flue-gases back near the fire port, for the purpose of regeneration or recuperation. Thus in the straight, tunnel-tank, under constructions so far described, only a straight flame-travel without preheating of air or gas is necessary. In the "U" and "L" types, the trough or tunnel is bent 180° or 90°, permitting the installation of a recuperator. Slight changes in design would permit regenerative firing.

The point to be emphasized is that the trough-type tank is a more effective melting unit because of the normal flow of the glass which it contains. Thus far this type of tank has appeared in small units. The development to be anticipated is the adaptation of the principle to larger units, with less wall-surface exposed per ton of glass carried, relatively less loss of heat by radiation, and higher heat efficiency.

The Chantereine Plate Glass Works

American Ceramic Society Foreign Travelers Will Visit the Most Modern Plate Glass Works of Europe

A short distance from the ancient city of Compiègne, with its historic castle, near the forest where the Armistice was signed in November, 1918, is situated the most modern plate glass works of Europe, the Plate Glass Works of Chantereine of the Saint-Gobain Company. To American readers these glass works are of special interest at this time, as this plant will be visited by the members of the American Ceramic Society who are taking part in the foreign tour of the Society.

THE Chantereine Plate Glass Works were built as a result of the Great War, to replace the two oldest plate glass works of the Saint-Gobain Company, namely that founded in 1692 at Saint-Gobain, and the one founded in 1800 at Chauny, both of which were almost completely destroyed by the long drawn-out battle of the Western front, which ended on November 11, 1918.

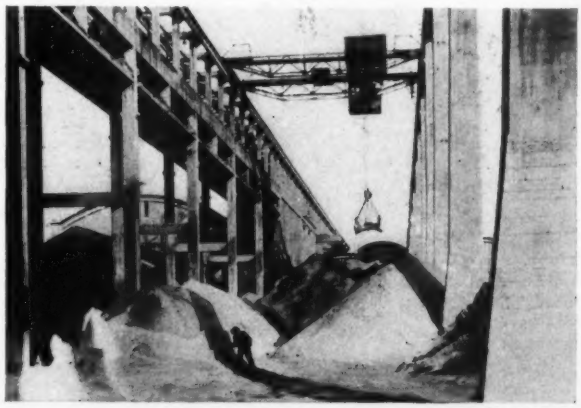
The new plate glass works of Chantereine are situated on a site that has been carefully selected—on the French Northern Railway as well as on the navigable waterway the River Oise—favorably located for obtaining the principal raw material, the sand. The works are half way between the Northern coal fields from which they draw their fuel, and the City of Paris, its principal market, where most of its product is sold.

The general arrangement and equipment of the workshops have been studied with a view to reducing manual labor to a minimum. The tonnage of raw materials, sand, limestone, soda ash, coal, etc. is considerable, and it is all conveyed from the canal wharf, and distributed to the different warehouses or stores by means of a system of aerial transport. Travelling cranes then carry these materials to the places where they are used. Materials delivered by rail are brought to sidings so situated that the same system of conveyers can operate.

The batch materials are carefully mixed, and are filled

(Cliché Draeger)

FIG. 1. AERIAL CONVEYOR AND OVERHEAD RAILS
General Stores for Raw Materials



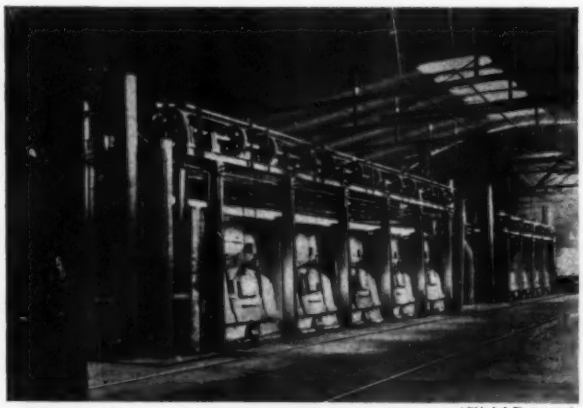
(Cliché Draeger)

FIG. 2. WHERE SAND IS STORED

into the pots by mechanical means, while the pots are in the furnace. The pot filling mechanism moves on a set of rails from one furnace opening to the next one, and so on, until all the pots in the furnace are filled.

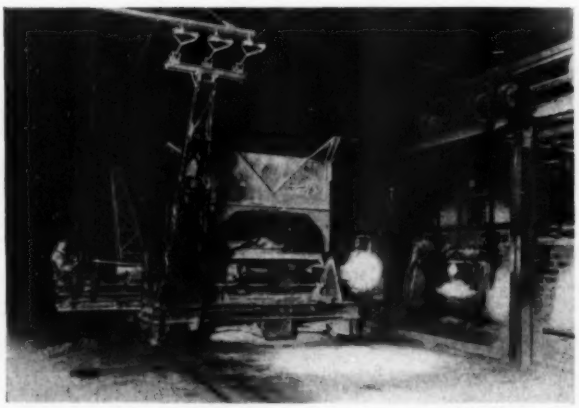
During the fusion process, the level of the mixture in the pots is lowered considerably, due to reduction in volume caused by the escape of gases, formed during the fusion reactions. In order to fill a pot to capacity three fillings are necessary.

The furnace management in plate glass manufacture is an extremely delicate operation. The molten glass should be heated to a very high temperature, so as to allow the escape of gas bubbles completely. It must be considered that the great weight of molten glass is held in a pot of refractory material, which itself is heated to a point not far below softening. A slight overheating may result in disaster to the pot. The plate glass manufacturer must therefore select the temperature which will allow the complete elimination



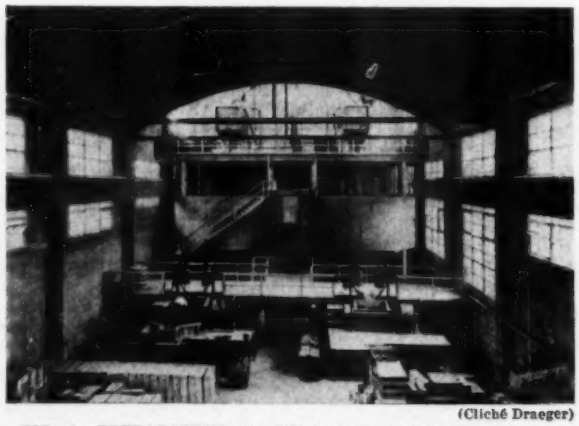
(Cliché Draeger)

FIG. 3. THE FURNACES



(Cliché Draeger)

FIG. 4. POT FILLING MACHINES
The Batch Mixture Is Put by Mechanical Means Into the Melting Pots



(Cliché Draeger)

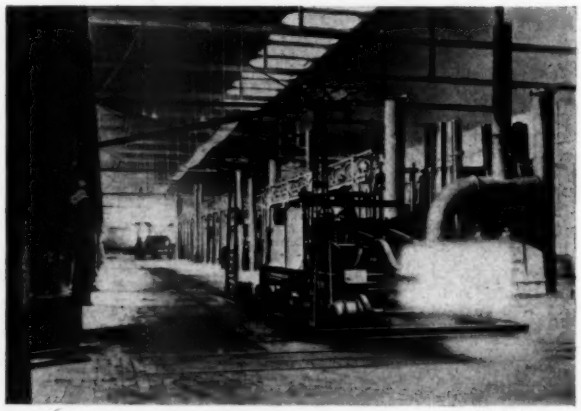
FIG. 5. PREPARATION OF REFRACTORY MATERIALS FOR PLATE GLASS POTS

(Cliché Draeger)

FIG. 6. MANUFACTURE OF A POT IS DONE BY HAND LABOR
The Pots Are Made in a Wooden Mold. They Hold About 240 Gallons

(Cliché Draeger)

FIG. 7. THE FINISHED POT



(Cliché Draeger)

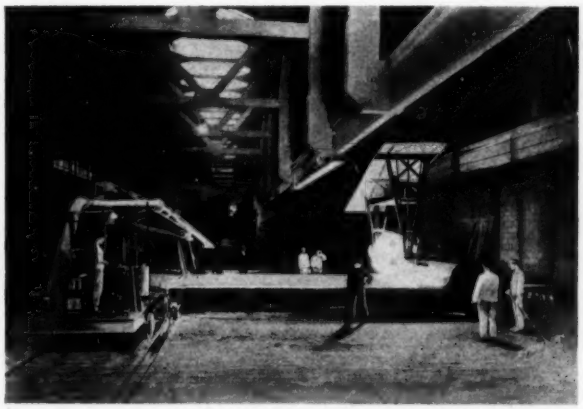
FIG. 8. POT REMOVING MACHINE

of bubbles and which will yet not be too high for the pots. For this reason the greatest care is given to the making of pots for the plate glass industry. Pots for plate glass manufacture are made by hand in wooden molds.

After they are finished, they are dried for several months in rooms where the temperature and moisture are carefully regulated. The drying proceeds very slowly. Only in this way is it possible to obtain pots that are able to resist the severe changes in temperature which they must undergo during the transfer of the pot to the casting table. From a white hot furnace, and filled on the inside with molten glass, the pot must be able to withstand the thermal shock of being exposed to normal temperature, without cracking.

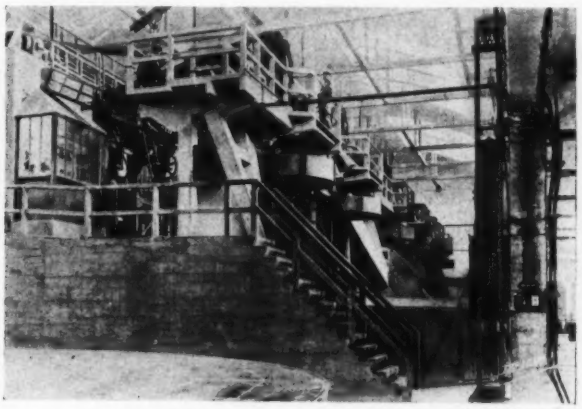
Before being put into service, the pots are heated in pot arches to a red heat. From there they are removed to the melting furnace, to replace pots that are no longer suitable for use. The life of a pot varies from 20 to 30 days.

For the daily casting, specially constructed machines worked by five motors, remove the pots from the furnace and



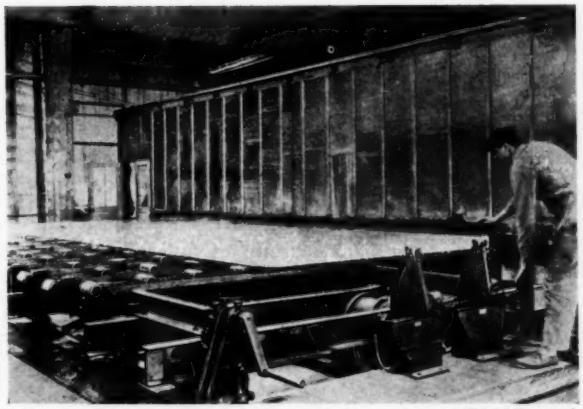
(Cliché Draeger)

FIG. 9. CASTING THE GLASS



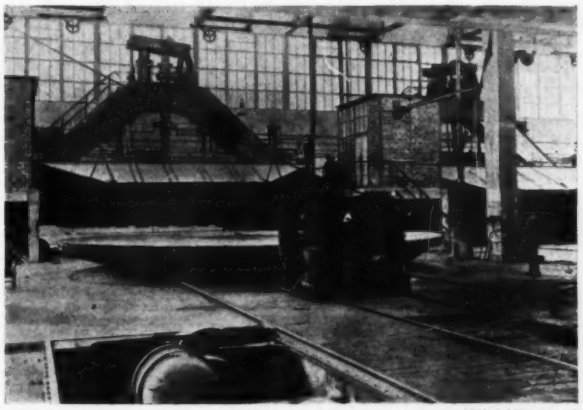
(Cliché Draeger)

FIG. 12. GRINDING MACHINES



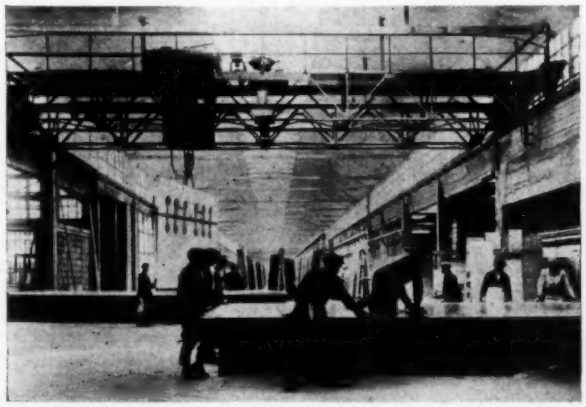
(Cliché Draeger)

FIG. 10. REMOVING THE PLATE FROM THE LEHR



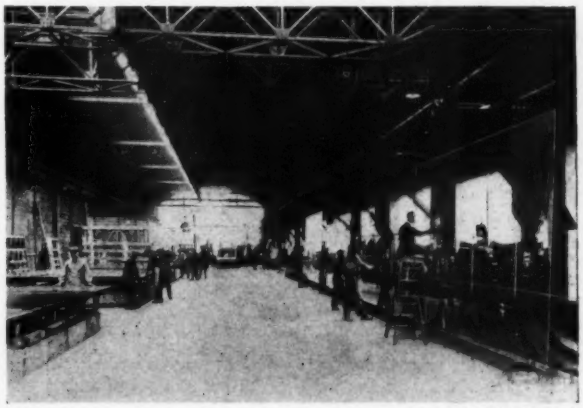
(Cliché Draeger)

FIG. 13. POLISHING MACHINES



(Cliché Draeger)

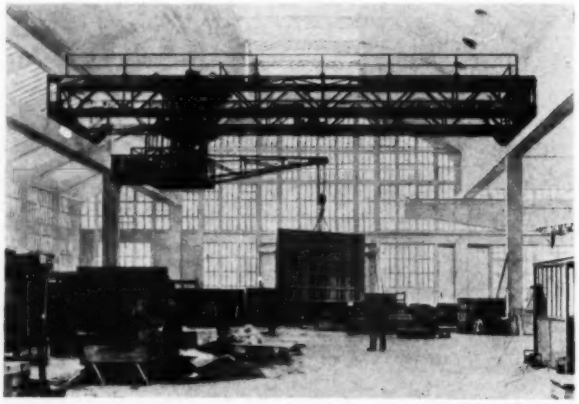
FIG. 11. CUTTING THE PLATE



(Cliché Draeger)

FIG. 14. INSPECTION OF FINISHED PLATE GLASS

place them under a travelling crane. The molten glass in the pot, suspended from the travelling crane is poured onto a cast iron table, on which it is rolled so as to insure a uniform thickness. Thus the rough-cast plate is obtained. As soon as the sheet of glass is rolled out, and while still hot,

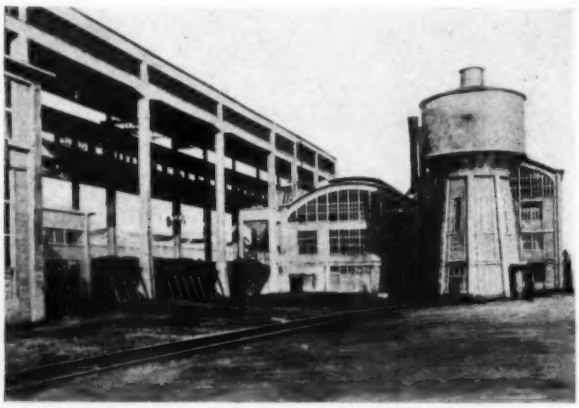


(Cliché Draeger)

FIG. 15. PACKING AND LOADING

the plate is pushed into the annealing oven, which is over 100 yards in length. In the lehr the glass is gradually cooled to normal temperature in about four hours.

A specially adapted truck receives the plate at the end of the lehr and conveys it to the cutting table, where the rough-



(Cliché Draeger)

FIG. 16. POWER HOUSE

cast plates are cut into sizes suitable for sale, and removed by a travelling crane, which places them in a vertical position in a large warehouse. From the warehouse the rough-cast plates are taken to round tables, about 11 yards in diameter, on which they are laid side by side, and embedded in plaster. The tables are then placed under the grinding and polishing machines.

The grinding is done by means of a series of special machines, each driven by a 500 h.p. motor. The polishing is carried on by another set of machines, driven by a 350 h.p. motor.

After one side of the glass has been ground and polished, the table is removed from the polishing machinery, the plates are turned over and the operations of grinding and polishing are repeated. The plates are then taken to the inspection room.

The inspection room is a well lighted space. Along the walls at intervals are suspended black sheets, which serve as a background for the plates of glass to be inspected. This facilitates the discovery of defects in the plate glass. Note is taken of any, even the slightest defects, and the plates are then cut to the best advantage. They are then graded according to quality.

The finished plates are packed in cases, which are moved to railroad freight cars. The largest plates are 24 feet long and 12 feet in width.

Power is furnished by the factory's own power station, which is connected with neighboring stations, so that uninterrupted flow of electric power at all times is assured.

(Cliché Draeger)

FIG. 17. WORKERS' GARDEN CITY —MARSHAL FOCH STREET

The Saint-Gobain Company has built homes for its employes, in pleasant surroundings. Among gardens attractively laid out have been built 450 dwelling houses with all modern conveniences. A hotel, shower baths, cooperative stores, dispensary with doctor and nurses in daily attendance, and a moving picture theatre are available to all.

Secretary of Labor Discusses Accident Prevention

"I am satisfied that an overwhelming percentage of the real accident prevention work now being done in the United States is being done by a very small percentage of the industrial establishments. The great need at this time is to interest the small and medium sized manufacturers and to impress upon them not only *the necessity for safety work* from a humanitarian point of view, but *from the point of view of their own pocketbooks.*

"The present premium rate for casualty insurance on small plants is in many instances prohibitive, and this is because the hazard or accident frequency rate in small plants is too high. The insurance companies feel that the only recourse open to them is to increase the rate on small concerns, which in turn throws these small plants with their employees out from under the protection of the workmen's compensation laws, which in turn tends to defeat the purpose of those laws, to wit, the protection of American workmen in case of industrial injury."—*James J. Davis.*

Potash Recovery Bill Passed

An appropriation of $50,000 for development of potash jointly by the Departments of the Interior and of Commerce, by improved methods of recovering potash from deposits in the United States, is provided for in a bill (H. R. 496) which passed the House May 21.

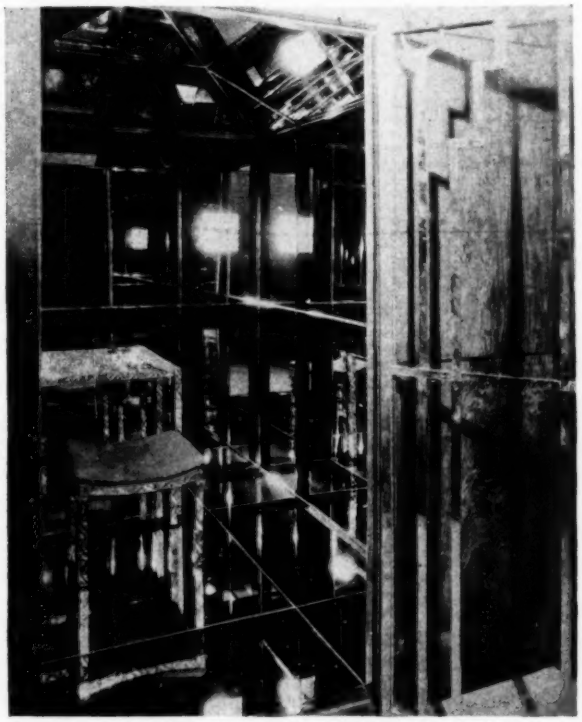
The funds are to be expended in research to determine improved methods for recovering potash from the locite, alunite and other potash-bearing deposits in this country.

America Demanding Art in Industry

Trend Shown by Public Interest in International Exposition Held at Macy's Department Store in New York

SPURRED not only by their own interests but also by a public-spirited purpose to point out to the people of the community the possibilities available for beautifying their homes and making them more comfortable, a great exposition of foreign and domestic-made artistic products (including glass) was held in the immense department store of R. H. Macy & Co. in New York, during the two weeks beginning May 14.

The success of the venture is attested by the fact that approximately 250,000 visitors attended, most of them showing intense interest in the beautiful and extensive displays provided for their benefit. A similar exhibition, but less comprehensive, was held two years ago in Lord & Taylor's establishment on Fifth Avenue.



MILADY'S POWDER ROOM
Floor, walls and ceiling all done in mirrors. Tent-like ceiling. Only furnishings are a table and stool.

Widespread interest in advancing the cause of "Art in Industry" was manifested at the opening meeting on Monday, May 14, which was particularly designed to acquaint the trade and magazine press with the purposes and objects of the exhibition. A number of speakers, including Robert W. de Forest, President of the Metropolitan Museum of Art, and members of the diplomatic and consular staffs of the foreign countries whose products were on display, were present and addressed the meeting.

Glasswares of innumerable designs and colors were shown, many world famous designers being represented. Unfortunately, but one American concern was in evidence, the Corning Glass Works, whose fine specimens of handwrought ware attracted much attention. Their exhibit included crystal cut and etched bowls and vases, perfume bottles of blue agate, crystal and pink perfume bottles, a bowl of cut crystal and agate and one of pink and blue agate, pink cameo vase, black and white jar, white bowl with black stand, plates, goblet, finger bowl, champagne glass.

The exhibition was modern throughout, with a few rooms on a separate floor designed as suggestions for the American family, and furnished more in the American styles, not so ultra-modern as some of the foreign designs.

There were approximately 300 exhibitors of 5,000 pieces.

At the opening meeting Percy S. Straus, vice-president of R. H. Macy & Company, spoke to the gathering in part as follows:

MR. STRAUS' ADDRESS

In opening this International Exposition of Art in Industry in the presence of this distinguished company, I want particularly to set forth our purpose.

Design and the use of color in America has adhered closely to classic models except in architecture. Germany, France, Austria, Italy and the Scandinavian countries, particularly Sweden, have shown in their contemporary art a definite trend towards innovations. There have been exhibitions in the United States of America of the new ideas of one or the other of those countries. However, a comprehensive exposition of the work of the outstanding designers of all of them has heretofore not been attempted, I am told.

Our purpose is to bring together such an exposition. We hope you will agree we have accomplished it. We trust it will serve the two-fold objective of interpreting the contemporary decorative arts of those countries in terms that will be understood in America and of being an inspiration to our artists and artisans.

Industry and commerce are the all-pervading factors of modern life and in no part of the world more so than in the United States. Art is the universal language of all civilization. The application of the universal language to the all-pervading factors has run in waves throughout the centuries. Today the wave is rising and we find a renewed interest in Art in Industry.

The present wave started in Europe in the countries in which similar waves have originated in times gone by. We in America have never before felt more than the weak backwash of such movements. Today, however, we are becoming distinctly conscious of an urge to add our power to the force that is trying to give artistic expression to the reactions on our surroundings of modern scientific discoveries. Thus far we have been content, except in architecture, to draw on Europe not only for our inspiration but for our method of expression as well. Now, however, there are signs that a

definite contribution may come from this side of the Atlantic.

In Paris the important department stores have been gradually taking the lead in the encouragement of Art in Industry. It is logical that they should. Where else can all the various articles be gathered to develop a complete ensemble? That their patronage is no less unselfish than that of the royal patrons of old should not in any way detract from the appreciation of their contribution to the development of the æsthetic in the life of today. They, too, add to their prestige by sponsoring activities not purely commercial. Moreover their clientele is the great middle class to whom artistic appeal must be made if an art movement of today is to become national.

Inspired by the lead of their Parisian fellow-merchants, the department stores of New York are beginning to interest themselves in the development of industrial art.

These activities of the department stores are symptomatic of the change in the outlook of their clientele. The man in the street and the wife in the home have become conscious of a desire for aesthetic values combined with physical comforts. The merchants as purveyors to the desires of the people must respond to this new consciousness.

Thus far we have had to look to Europe both for inspiration and to a large extent for execution. The next step is to give the new movement in Art a native twist, to make it a part of our lives. When the Art of the Renaissance came to France from Italy it was at first copied, then adapted, and finally given a French accent that differentiated it absolutely from its origin.

Inspiration to artistic achievement has always moved from east to west. That process has not changed. We in America, inspired by the artistic achievements of the countries whence we sprang, may still develop an interpretation distinctly our own. If so, it must be by the co-operation of interested individuals as widely different in occupation as you who are here this morning.

America's receptivity to new ideas is due in great measure to its remarkable facilities for communication. Ideas which once took years to percolate now become immediately available to all the people. The telephone, the radio, the automobile and the aeroplane have destroyed the handicap of distance. They are today working for a possible American point of view in art as well as in commerce. At the same time, those of you who control communication through the interpretation of the news in the great magazines of the country, will have a powerful influence in laying the foundation for a national development in art.

Abstracts from the Remarks of
ROBERT W. DE FOREST
President, The Metropolitan Museum of Art.

For a long time, I think, certainly going back to the times of my youth, art seemed to consist simply of pictures and statues. Now we have passed that. Art enters into everything, every one of our surroundings. It is not merely pictures; it is not merely statues. It enters into everything which comes into our homes. There can be just as much art in your curtains, covering up your furniture, your tableware, even in your kitchen utensils—there is art in everything, and the important thing is to surround ourselves with it and to bring up our children in such surroundings that they will learn to have an enjoyment of it.

It is hard for us perhaps to realize how universal that is. You go into a room—there may not be a picture there, there may not be a statue there, but the room is harmonious. It is harmonious in color. There is harmony in form. You feel a sense of satisfaction. You feel a sense of enjoyment. It may be subconscious, it frequently is such, but if you analyze your feelings on going into a room, you will find that it makes a great difference to you how that room affects you.

Art is not costly. Good art is not costly. Beautiful things are not necessarily costly. I do not mean that there are not many very costly beautiful things here in art. As I hastily glance over this catalog, I see the names of the great European producers of industrial art, names that I became familiar with at the Paris Exposition of 1925. They are represented here, and they must be represented, as I imagine, by very costly things; but good art, and the enjoyment of good art, does not necessarily depend upon cost.

The great French jeweler and worker in glass, Lalique, had an exhibit in the Paris Exposition of 1889, that I recall. It was an exhibit almost exclusively of jewelry and glassware of the most costly kind, certainly

A DISTINGUISHED GATHERING OF DIPLOMATIC AND CONSULAR OFFICIALS WHO ATTENDED THE FORMAL OPENING OF MACY'S EXPOSITION, IN WHICH SIX NATIONS PARTICIPATED.

Left to right: (1) Olof Lamm, Consul General of Sweden; (2) Baron Wilhelm von Prittwitz und Gaffron, German Ambassador to the United States; (3) Dr. Gustav Heuser, Acting German Consul General; (4) Percy S. Straus, vice-president of Macy's; (5) Edgar Prochnik, Austrian Minister to the United States; (6) Dr. Frederick Fischerauer, Consul General of Austria; (7) Jules Henri, First Secretary of the French Embassy; (8) A. Brouzet, Acting French Consul General; (9) Romolo Angelone, Commercial Attache to the Italian Embassy.

not within the reach of any modest purse. I recall the exhibit of the same Lalique of Paris in 1925. There were those costly things, there were those beautiful things, but beside them were I should say equally beautiful things in glass, not at all costly; and when I went to the Paris museum that devotes itself particularly to what we call industrial art, I found those cheap things produced by Lalique occupying a place in the show-cases of that museum parallel to and with the same dignity as some of the most costly things which he produced at the same time. Therefore, get rid of the idea, if you have any, that good art means high cost.

Now, there is one reason why, in preaching this gospel of beauty, and the enjoyment of beauty, such a department

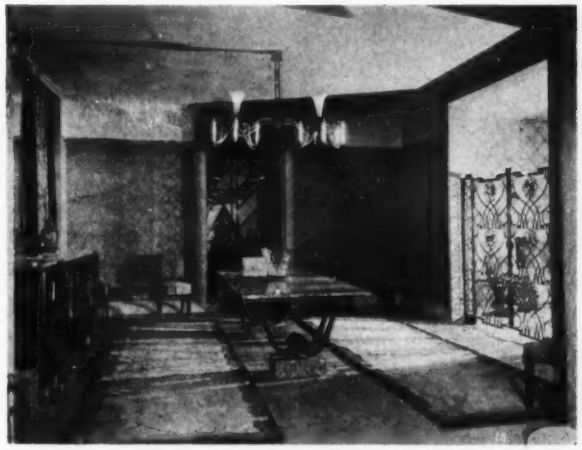
COMBINED BATH ROOM AND DRESSING ROOM
Between the glass dressing table, which is flanked with glass shelves, and the jade green bathtub, is a shower room with a glass door.

store as this has perhaps an advantage over a museum. It has the advantage of a special exhibition. It has the advantage of attracting a good many people who come here to see what is new. It has this additional advantage which a museum does not have: You can obtain, you can take away, you can buy, you can bring these things into your own home. In a museum you can see, you can look, but, unless you violate all the rules of property, you cannot take. (Laughter.) Here I am not sure that you can take, but I am sure that you can order, so that you can obtain what you see and what you enjoy. There is the great opportunity of a movement of this kind; and it can spread all over the country. It need not necessarily be confined to Macy's. It can go elsewhere. It can put beauty within the reach of everyone, and it is this solidarity of effort that inspires all of us, whether we are museum people or whether we are department store people, or whether we are school people, or whether we are manufacturers, or whether we are the salesmen or the sales women for stores of this kind. You have the opportunity of putting within the hands of everyone, rich and poor, things of beauty.

THE CHAIRMAN (Dr. John H. Finley): I wonder if you do appreciate that you are taking part in—I will not say an epochal event—that may seem a little extravagant, but I cannot think of another word at the moment. Here is the President of the Metropolitan Museum of Art, the first art museum in America, and I will not make further comparisons in the presence of these men from abroad—here he is at a department store, where we hear the bustle of trade, and talking about art in industry in this most impressive way. This will be remembered, I think, as a meeting of great significance.

Now I am going to introduce some very distinguished gentlemen from abroad; I will simply read a general introduction. This introduction is not mine, it is that of a man who was imported to America. His name was Franklin Lane—one of my dear friends who is gone. He tried to catalogue, and it is the most beautiful catalogue I have ever read, the gifts which others have brought to America. I will read only a portion of it:

"America is a land of but one people, gathered from many countries. Some came from love of money, and some for love of freedom. Whatever the lure that brought us, each has his gift. Irish lad and Scot, Englishman and Dutch, Italian, Greek and French, Spaniard, Slav, Teuton, Norse, Negro, all have come bearing gifts and have laid them on the altar of America. All have brought their music, dirge and dance, and wassail song and march and religious chant; all brought music and their instruments for the making of



A MODERN FRENCH DINING ROOM
With stained glass window. Designed by Maurice Dufrene and executed by La Maitrise of Paris.

music, these many children of the harp and the lute. All brought their poetry, all brought their fancies of the mind, woven in wood or wool, silk, stone, or metal; rugs, and baskets; gates of fine design and model gardens, houses and walls, pillars, roofs, windows, statues and paintings. All brought their art and handcraft too.

"Then each brought some only thing, some touch of the familiar home field or forest, kitchen or dress, a favorite tree or fruit, an accustomed flower, a style in cookery or in costume—each brought some home-like and familiar thing.

"We have taken," he said, "an oath that the world shall have a chance to know how much of good may be gathered from all countries, and how solid in its strength, how wise, how fertile in its yield, how lasting and sure, is the life of a people who are one."

And here we have such an exhibition this morning.

The Glass Industry

ESTABLISHED 1920

The First Trade Journal Devoted Primarily to Glass Technology, Engineering, Raw Materials, and Glass Factory Equipment and Operation

Published Monthly

Copyrighted, 1928, by

GLASS INDUSTRY PUBLISHING COMPANY, INC.
50 Church Street, New York

Telephones { Cortlandt 2465 / Cortlandt 5618 — Cable Address, Glasdustry

J. B. KRAK, Technical Editor

Subscription Price.....$2.00 a Year
Single Copy.....20 Cents

THE GLASS INDUSTRY circulates extensively among American and foreign glass manufacturers, their business executives and technical and factory operating staffs.

CONTRIBUTIONS

THE EDITOR welcomes practical articles on all subjects related to GLASS MANUFACTURING. Such articles, if accepted, will be paid for at our usual rates.

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Art in Industry

During the past few years the interest in improving the design of articles of every day use in the home has increased visibly. Three years ago the United States was not represented at the International Exposition of Decorative Arts in Paris. We only sent "observers." The last twelve months have seen two exhibitions in New York City's leading department stores. From May 14 to May 26 Macy's has exhibited furniture, pottery, silverware, jewelry and glassware, brought together from numerous countries.

The glass exhibits were among the most interesting features, showing a variety of shapes and colors of great originality, and in many cases of great beauty.

The object of the exhibition was to arouse in the public a greater desire for the possession of objects, of daily use in the home, that combine beauty of design with practical utility.

In days gone by, articles like those exhibited were produced in the small factory and through home industry. Modern industry has transformed these small industries, with their products of strong individuality, into great enterprises in the name of efficiency. And it has accomplished wonders, but the element of art has been largely crowded out, and the man of limited means has been forced to content himself with the products of mass production. "Herein has lain the tragedy of American supremacy in mass production," said Robert W. DeForest, President of the Metropolitan Museum of Art in his opening speech, "for so much of the bad could just as easily have been good."

The public is becoming aware of the fact that beauty of design and color in an article does not necessarily mean high cost, and that cheapness and ugliness are not synonyms. To prove this, the director of the Newark Museum bought a number of objects from five and ten cents stores and exhibited them in his museum, in order to show that one does not have to spend a great deal of money to obtain beautiful things.

Manufacturers of fine table glassware in this country recognized the modern tendency years ago, and at the present time there is no country producing finer, better designed and more beautifully colored glass ware, obtainable at a reasonable price. In this department of glass manufacture progress has been steady, and much has been accomplished.

A great field for improvement in design and coloration is the glass container industry. It costs no more to produce a well designed glass container than an ugly one. The expense of coloring materials is negligible, in most instances. Consider the ginger ale bottle. Ginger ale is being made by a number of extremely live concerns, thoroughly aware of the selling power of a well designed, pleasingly colored container of their product, which is aggressively advertised the country over. Were they content with the drab, poorly colored, indifferently shaped container of the beer bottle type? Certainly not. They designed a practical, well shaped, attractively colored bottle, having every quality desired from the standpoint of practical utility combined with beauty. The results are that no new concern making ginger ale would for a moment consider to sell their product in the old style bottle.

Neither would the public consent to buy such an article.

The public is being educated by the department stores, by progressive manufacturers, the press, the moving pictures, by every agency of modern progress to demand better things. Mass production has relieved us from drudgery to a considerable extent, and has given us reasonable working hours together with the means to fill our leisure. Art in industry is not a fad that will die out in a few years. It is the logical outcome of a period of development that is now coming to full fruition. The manufacturer who can take this tide while it is high, will benefit most of the modern tendency.

We will nevermore be content with the amount of ugliness in our surroundings of the earlier days of the machine age. Styles will continue to change, different colors and varying designs in glassware will be demanded. But we may be quite certain that with increasing prosperity, and with the ever widening effects of education and diffusion of knowledge among all classes of society it will be impossible to stem the rising tide of art in industry.

Some New Facts Arising from a Study of the Casing of Colorless by Colored Glass

At a recent meeting of the Society of Glass Technology at Sheffield, a paper by S. English, Prof. W. E. S. Turner, and F. Winks was presented by Prof. Turner. An abstract follows:

Three series of glasses had been employed, the one being soda-lime-silica glasses colored by cobalt oxide up to 0.49 per cent. The second consisted of potash—lead oxide—silica glasses colored by cobalt oxide up to 0.9 per cent, while the third series consisted of commercial soda-potash—lead oxide—silica glasses, colorless, ruby, green and blue.

The coefficients of expansion of these glasses were determined by a differential method of great reliability, the results being plotted graphically against temperature over the range from 0° to the upper annealing temperature. It was found that in the first series of glasses the greatest difference produced by the addition of 0.49 per cent of cobalt oxide in the expansion up to the lower annealing temperature was not greater than 3 per cent, while the maximum displacement of the lower and upper annealing temperatures was of the order of 5 deg. Hence, no difficulty should be found in welding any of these glasses.

With the second series of glasses it was found that the expansion did not differ appreciably up to the lower annealing temperature, but this temperature was displaced progressively upwards, the displacement reaching some 25 deg. for the glass containing 0.9 per cent cobalt oxide, as compared with the parent glass. Similar displacement of the lower annealing temperature was found in the series of commercial glasses. It was found to be possible, experimentally to weld any of the glasses successfully.

The rate of setting, and the effect of radiation were investigated for the soda-lime-silica, and potash-lead oxide-silica glasses, while the viscosities were also determined over a wide temperature range, for the former series. When worked commercially the blue glasses set more rapidly than the colorless one, yet the viscosities as measured in a closed vessel were not greatly different at any given temperature. The outer layers of the colored glasses cooled more rapidly than the colorless, due to more rapid loss of heat by radiation.

A number of important principles were established including:

(1) The rate of thermal expansion in some glasses, such as the soda-lime-silica, soda-potash-lead oxide-silica, and soda-iron oxide-silica undergoes changes, not only at the lower annealing temperature but also at one or more definite points below that temperature.

Some series, however, such as the potash-lead oxide-silica series have constant thermal expansion coefficient up to the lower annealing temperature.

(2) In some glasses, especially lead oxide glasses, quite small amounts of coloring oxides appear to raise the lower annealing temperature substantially.

(3) Viscosity determinations in closed vessels do not necessarily afford a measure of the rate of setting of glasses worked under commercial conditions. This is specially true of colored glasses. The rate of loss of heat from the outer layers either of radiation or by conduction must be taken into account.

New Books

EARLY AMERICAN GLASS, *by Rhea Mansfield Knittle, XXIII and 496 pages, illustrated with 64 plates; size 5½ x 8½. Published by The Century Company, New York and London. Price* $4.00.

This book, written by one who is a recognized authority in the field of antiques and glass history, is one of the most valuable contributions on the subject of old glass that has appeared.

The author takes up five phases of early glass; first, what is glass; second, the beginnings of glass; third, processes and tools of the trade; fourth, molds and mold makers; fifth, attribution and authentication. The periods covered are divided into the earliest beginnings in America, 1609-1737; the second period, 1737-1827; the third period, 1827-1864.

The illustrations are unusually fine and include pictures of displays and collections of the Metropolitan and the Toledo Museums of Art, and of a large number of private collectors.

Not only to the student of history and to the antiquarian, but to the manufacturer of glass who desires to obtain a better understanding of his work, this book is of great value and of compelling interest. It contains a vast amount of information that concerns the modern manufacturer, the collector and the dealer in antiques.

CERAMIC TESTS AND CALCULATIONS, *by A. I. Andrews, Ph. D., Assistant Professor of Ceramic Engineering, University of Illinois, Urbana, Ill. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York. Size 5 x 7½ inches, VIII and 172 pages. Bound in cloth. Price* $2.25.

There has long been a demand for a book containing the necessary data for ceramic calculations, which would obviate the need of going through numerous periodicals to secure the information required.

The first part of the book deals with the consideration of clay tests their calculation and interpretation, including the raw materials, drying and burning properties, and the preparation of the finished products. The last part explains the calculations relative to glazes, bodies, enamels and glasses.

In the Appendix are included tables of atomic weights, molecular weights, equivalent weights, melting points, solubilities and standard sieve data, pyrometric cones, temperature conversions, logarithm tables and weight, volume, length relations and conversions.

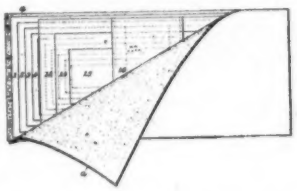
The author deserves thanks for producing a work that will save the ceramic technologist a great deal of time and expense.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

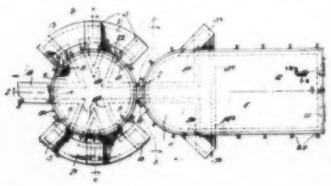
Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

METHOD OF AND APPARATUS FOR LAMINATING GLASS UNDER INCREMENTAL DIFFERENTIAL PRESSURES. U. S. 1,667,832. May 1, 1928. L. Bartelstone, Flatbush, N. Y. Filed 6/27/26. All tendencies towards "pocketing" of air or excess fluid may, it is claimed, be very efficiently yet easily precluded by the application of a differentially graduated compression, whereby the ultimate contact grows from a more or less central spot and progressively lengthens and spreads spoke-like or branch-like; permitting the fluid to escape through flared channels which gradually shorten and narrow (until ultimately eliminated) as the cohesion extends.

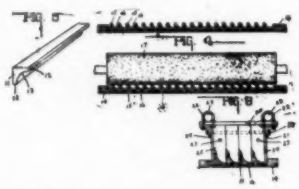


LAMINATED GLASS. U. S. 1,669,044. Frank Fraser, Toledo, O. May 8, 1928. Filed 6/30/28. One object is to provide a process of producing a sheet of laminated glass, and relates particularly to the joining of a sheet of glass and a sheet of non-brittle material, the sheet of non-brittle material containing an oil which is brought to the surface to form a film to assist in creating an effective and permanent bond between the two sheets.

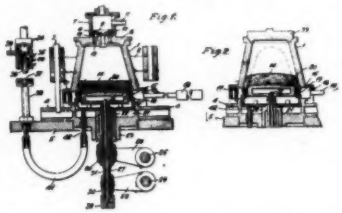
GLASS MELTING AND REFINING TANK. U. S. 1,668,700. Gilbert E. Stickler, Okmulgee, Okla. May 8, 1928. Filed 5/5/27. A regenerative glass melting and refining tank including a melting section of circular form in plan provided with side sets of opposed radial regenerator ports, and a refining section having a rear receiving end portion of rounded form in plan provided with side opposed regenerator ports, there being a passage connecting said sections, the melting section having a rear batch supply opening, and the refining section having a forward glass delivery end, regenerators connected to said melting section ports, arcuate horizontal manifolds connecting the lower ends of said regenerators, and a longitudinal main flue extending rearwardly beneath the tank and having radiating branches connecting to the manifolds, and regenerators connected to said refining section ports, said longitudinal main flue extending rearwardly beneath the tank and having lateral branches connecting to the refining section regenerators.



PROCESS AND APPARATUS FOR MANUFACTURING GLASS CORNER STRIPS. U. S. 1,668,576. William Uhl, Indianapolis, Ind. May 8, 1928. Filed 7/25/27. The process of manufacturing corner and base strips of glass consisting of rolling a sheet of glass in a flat blank, applying a die to the surface thereof while in a plastic state and pressing it therein to form a plurality of parallel ridges and depressions, said depressions having the desired concave curvature in cross section of the finished strip, and cutting said glass between the ridges formed thereon and adjacent recesses at the thinnest part thereof, whereby said glass will be formed into a plurality of strips having a surface running longitudinally thereof concave in cross section and of the desired curvature. Fig. 3 is a sectional view taken across the corner strips. Fig. 4 shows the grinding of the exposed edges of the strips. Fig. 5 shows the finished strip. Fig. 6 shows the die head pressed into the glass blank.

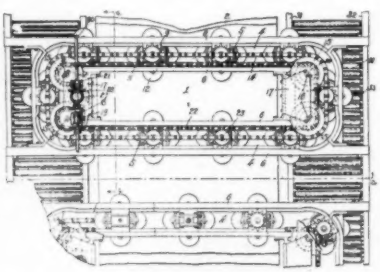


APPARATUS FOR SHAPING GLASSWARE. U. S. 1,668,993. May 8, 1928. D. P. Weaver, Bridgeton, N. J. Filed 2/2/28. When it is attempted to produce rectangular wide mouth ware such as battery jars by the pressing method, difficulty is encountered in forcing the glass into the corners and upwardly into the mouth finish portion of the mold. An object of this invention is to avoid such difficulties by providing apparatus by means of which a parison may be formed by the blowing method. A charge of glass is introduced through the open bottom of an inverted blank mold and is settle-blown to compact the glass around an elevated plunger and between this element and a neck ring. The plunger co-operates with the neck ring in forming the mouth and finish of the ware, and an internal member in the form of a rectangular plate, which forms an initial blow cavity in the glass substantially coextensive with the mouth of the ware. The internal member of the plunger is then elevated an additional amount, which enlarges the cavity, and stretches the skin lining the cavity sufficiently to free the glass from adhering contact with the plunger and also to strengthen the skin enough to prevent its collapse when the plunger is withdrawn.



The internal member of the plunger is then retracted and the charge is counter-blown to form the parison. The external member of the plunger is then lowered, the mold is opened, and the parison is manually transferred to the finishing-mold or blow mold by means of the neck ring, which may remain in engagement with the glass during the blowing operation.

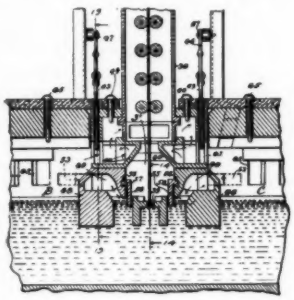
CONTINUOUS GLASS-POLISHING MEANS. U. S. 1,666,347. April 17, 1928. A. W. Platt of Toledo, O. Filed 9/3/26. An object of the invention is the provision of a simple, efficient and practical machine, which is entirely automatic in its action and is adapted to effect a continuous polishing or grinding of the exposed top surface of plate or sheet glass as it is moved either intermittently or continuously at a slow speed under the polishing means. A further object is the provision of means for automatically, at predetermined intervals, cleaning or reconditioning the felt covered working surfaces of the polishing members.



GLASS. U. S. 1,669,908. May 15, 1928. Bernard Long, Paris, France. Filed 1/12/26. A soda lime glass having metallic elements therein which is affected by waves of short length and containing not over 3% of oxide of lead.

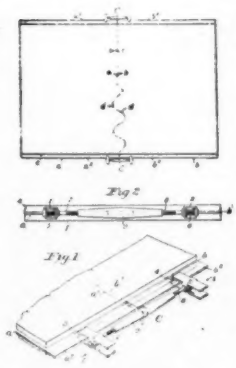
CHARGING DEVICE FOR GAS PRODUCERS, SHAFT FURNACES, AND THE LIKE. U. S. 1,668,968. May 8, 1928. Joseph Lambot, Brussels, Belgium. Filed 12/10/26. By means of suitable mechanism a movable inclined trough situated at the upper part of the furnace is given a uniform movement of rotation about a vertical axis in line with the axis of the furnace while at the same time it is subject to continuous or periodic variations of inclination in a vertical plane. Since these two movements have different periods, all points of the surface of the furnace will, it is claimed, successively receive the same amount of material.

GLASS FURNACE. U. S. 1,663,839. Mar. 27, 1928. Thomas B. Hart, Libow, W. Va., assignor of one-half to Blackford Window Glass Co. Filed 11/6/25.



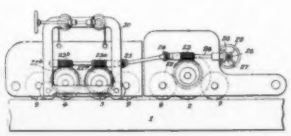
An object of this invention is the provision of an improved skimming device between the melting furnace and the drawing furnace. Also an improved arch construction utilized in connection with the melting furnace to divide the air and gas passages leading to the mixing chamber, and improved apparatus for moving sections of the aforesaid arch into position whereby the sections may be replaced quickly and readily while the furnace is in complete operation. Also an improved mixing chamber communicating with the combustion zone of the furnace. An improved and removable plate block forming a floor at the mouth of the mixing chamber communicating with the combustion zone in the furnace is provided, with which it is possible to remove the same quite readily and replace or repair it without disturbing any other construction than the plate block proper, and will not interfere with the operation of the furnace whatsoever. Another important object resides in the particular construction of the melting furnace and its crown or roof which together may be termed of a "Zeppelin" type, constructed to avoid the provision of corners and square portions of parts. Other objects reside in providing a crown for the melting furnace which is constructed of tongue and groove arch brick being set so as to eliminate fire from eating through the joints and burning or charring the heat conductive qualities of the insulation brick, an improved annealing mechanism used in connection with each drawing well at the base of the drawing machine.

METHOD OF SPLICE-LAMINATING GLASS. U. S. 1,666,252. April 17, 1928. L. Bartelstone, Flatbush, N. Y. Filed 7/27/26.



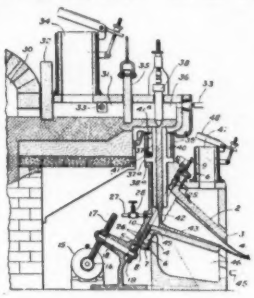
This invention proposes a new method of, and apparatus for, performing splice-laminating of glass without the necessity of initially joining the celluloid sheets. The method consists in initially forming the adjacent edges of the celluloid sheets so that they will each be an exact counterpart of the other so that when their edges are subsequently brought into butt contact only a faint hair line will be visible at the juncture. These sheets are then inserted between plates of glass (which have been coated with the usual uniting fluid) and their mating edges are brought into abutting relation so as to effect a substantially continuous sheet; only the faintest line being perceptible at their meeting edges. The two sheets are then secured against relative movement and the assembled glass plates and the spliced sheets of celluloid are inserted within the usual power press which serves to expel the uniting fluid and to effect a permanent union between the glass plates and the intervening spliced sheets of celluloid.

GLASS WORKING MACHINE. U. S. 1,668,200. May 1, 1928. N. Franzen, Long Beach, Cal. Filed 3/31/26.



Improved apparatus for continuously or intermittently forming molten glass in sheet form, either plain or wired, in a rapid, efficient, and economical manner, and further, it has for its object the provision of a new and novel adjusting mechanism for varying the distance between a roll or rolls and the support for the plastic material as in sheet-glass forming machines for regulating and maintaining the desired thickness of the glass-sheet being formed.

MANUFACTURE OF GLASS TUBING AND CANE. U. S. 1,663,093. March 20, 1928. K. E. Peiler, West Hartford, Conn. Filed 1/3/27.

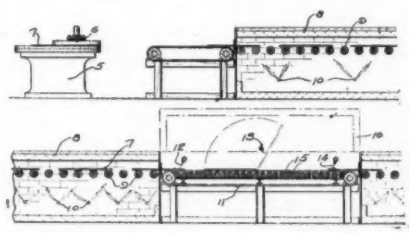


The method of drawing glass continuously in tubular form that comprises flowing a stream of molten glass upon the inner surface of a tapered receiver having substantially its entire interior unobstructed, maintaining superatmospheric pressure within said receiver, rotating said receiver to wind a layer of glass upon the said inner surface of said receiver, and withdrawing the glass from the smaller end of said receiver.

GLASS-DELIVERY APPARATUS. U. S. 1,669,475. Richard La France, Toledo, O. Filed 8/21/26. Glass delivery apparatus comprising a revolving tank, and means for feeding molten material to substantially the center of the tank.

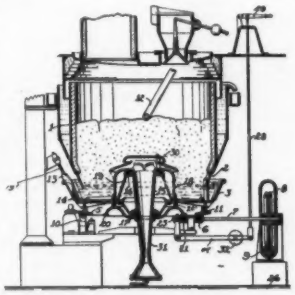
SHEET GLASS. U. S. 1,669,663. Edward H. Hobbie, Boonton, N. J. Filed 4/4/24. A sheet of glass for distributing rays of light passing therethrough in such directions that substantially all rays of light passing through the sheet of glass are directed so as to have a vertical component of direction when the sheet of glass is placed in a vertical plane, said sheet of glass having a plain surface through which rays of light pass when entering the sheet of glass, and a figured surface having a multiplicity of pyramid configurations produced by intersecting grooves and imaginary ridges defining triangular planes and vertices respectively of the pyramid configurations, all of said grooves and imaginary ridges running obliquely to at least one edge of the sheet of glass whereby the side intersections of the triangular planes of the pyramid configurations lie in planes perpendicular to at least one edge of the sheet of glass.

SHEET OF GLASS AND PROCESS OF PRODUCING THE SAME. U. S. 1,667,146. April 24, 1928. John L. Drake, Toledo, O. Filed 3/27/26.



The process of producing polished sheet glass, consisting in grinding both surfaces of a sheet of glass, passing the ground sheet through a heating chamber, fire-polishing one side of the sheet, then turning the sheet over and fire-polishing the second side, and then cooling said sheet. By grinding the sheet prior to its polishing, in accordance with the present invention, all surface defects are removed so that a ground blank is produced having flat surfaces and a sheet of uniform thickness.

GAS PRODUCER.. U. S. 1,666,604. April 17, 1928. C. W. Lummis, Worcester, Mass. Filed 12/19/21.



In a gas producer, an ash pan, a fuel shell, peripherally arranged supports connecting said shell with the ash pan bottom and uniting pan and shell for rotation in unison without obstruction to the free descent of ashes into said pan from said shell, means for rotating said pan and shell in unison during the operation of the producer, a separate rotary plowing member within the ash pan, and effective on the ashes therein at the lowest level reached by said ashes prior to their discharge from the producer, thereby to procure movement of said ashes on the ash pan bottom beyond said peripheral supports, said plowing member, when free, being rotatable in unison with said pan, and means for independently

rotating said plowing member at a different speed from the pan.

Correction

Owing to a printer's error, the word "Sulphite" has been used instead of "Sulphide," in the title of the patent issued on April 10, 1928 to Elbert E. Fisher, Toledo, Ohio. (U. S. Patent No. 1,665,694) May number, page 113.

Book on Patent Laws

THE LAW OF CHEMICAL PATENTS, *by Edward Thomas, member of the New York and District of Columbia Bars; New York Patent Law Association; American Chemical Society; associate member, American Institute of Mining and Metallurgical Engineers. XIII and 358 pp. Table of cases, 37 pp; Legal and Industrial terms used, 11 pp; Size 6 x 9 inches. Published by D. van Nostrand Company, New York. Price* $6.00.

This book is of value to anyone concerned with patents, covering chemical inventions, whether as inventor, promoter or expert. The content of the eighteen chapters is largely made up of legal opinions, applying to the topics discussed. A number of Court opinions regarding patent suits on glass making inventions occur in the book.

A short introductory section opens each chapter, in order to enable those unfamiliar with the technicalities of patent law to grasp the principles briefly summarized in the rulings of the Courts, since the latter are the final arbiters of the patent law.

Since chemical inventions differ fundamentally from mechanical inventions, the patents applying to each group differ greatly. Questions arising on patents can only be answered by learning what decisions the Courts have already rendered in previous cases. It is the purpose of this volume to collect and classify opinions previously given by the Courts in a large number of patent lawsuits. An important feature is that it shows to chemists and lawyers what can and what cannot be patented. A careful reading of this volume may prevent much waste of time and lawyers' fees to chemical research workers and their employers.

Glass Factory Equipment and Supplies

Most of the information printed in this department comes direct from the manufacturers of the products described.

New Gas Producer for Anthracite

The Dover Boiler Works, 50 Church Street, New York, has brought out the Dover-Galusha Gas Producer, an improved type licensed under the A. L. Galusha patents. A booklet describing this new machine has been prepared which will be sent to those interested on request. The new producer is designed particularly for the use of anthracite fuel. A.S.M.E. tests are given in the booklet on the fuel and water consumption, gas quantities and analysis, ash quantities and analysis, and a heat balance which shows a total efficiency, including credit for surplus hot water, of 94.9%. The net hot gas efficiency is 93.4% and the coal gas efficiency 87.8%. These analyses and calculations are by Prof. Lincoln T. Work of Columbia University. The producer is fully water jacketed. It is claimed to be decidedly in advance of current practice in the low cost of gasification of very cheap fuels. Some of the claims made for this machine are that the grates have no perforations through which extremely fine fuel can be wasted and the elimination of water seals makes it practicable to carry blast pressures of several pounds if necessary, to overcome the resistance of very small fuels. A half-pound of hot gas pressure can be maintained at the burners, without having to cool, boost, and reheat the gas. Waste heat in the water jackets generates the steam for making gas, saving a dollar or more per ton of fuel gasified. Efficiencies up to 93% are obtained by this conservation of heat, and important labor economies are effected simply because clinker will not build up on the smooth water-cooled steel walls. There are no moving parts in the fuel feed. No investment is necessary for boiler plants or refractory linings, and very ample coal and ash bins are included in the producer unit.

New G. E. Protective Cream for Hands

The Research Laboratories of the General Electric Company have developed a protective hand cream which is furnished as a safety measure to those men in G. E. plants whose hands and arms are exposed to oil, grease, dirt, varnish, paint and other causes of skin discoloration and irritation encountered in industrial processes. It is applied before beginning work and forms an invisible film which quickly dries and is not slippery. Subsequent washing in warm water quickly removes the film and with it the stains which otherwise fill the pores of the skin and are difficult to remove, and likely to cause infection.

This cream has now been placed on the market by the merchandise department of the company at Bridgeport, Conn. It will be packed in tubes to sell at 25 cents per tube for individual use and also in one pound cans for industrial use.

Subox, a material designed to protect from corrosion such materials as iron and steel, concrete, wood, wall board, etc., and said to be particularly suitably for general factory use, has been put on the market by "Subox Inc.," New York City. It is applied like an ordinary paint. It's main component is suboxide of lead which it is claimed goes through an electro-chemical process and upon exposure to the air forms a protective coating on the object to which it is applied.

Sil-O-Cel Insulating Materials and Allied Products.—A sixteen-page bulletin, issued by the Celite Products Company, Los Angeles, Cal., giving detailed information on the physical characteristics of the various Sil-O-Cel products and general information concerning the methods of using them. Among the products described are: Sil-O-Cel Standard Brick, C-22 Brick, Super Brick, Rotary Kiln Brick, Insulating Mortar, Sil-O-Cel Powder in various grades used for insulating purposes, Sil-O-Cel C-3, and Concrete Specifications for Making Sil-O-Cel blocks, Plastic Cement, Celcote Waterproofing and Fraxite High Temperature Cement. Charts showing the conductivities of the various insulating material and the methods of using them is given the company offers to submit detailed recommendations covering the type of insulation required for any specific insulating problem.

Lange supplies, tools and machinery for the glass, trimming and body shop. Catalog No. 828, issue by Henry G. Lange Machine Works, 156-166 North May Street, Chicago, Ill. This is a fifty-page catalog containing hundreds of items, including standard glass pliers and nippers, diamond cutters, glass cutters' tools, circle and oval cutters, windshield gauge, glass edging and beveling machines, roughing, smoothing, and polishing wheels, roughing plates, cork wheels, wood wheels, putty knives, stills for mirror shops and a large number of other items.

The Wickwire-Spencer Steel Co., 41 East 42nd Street, New York, after months of constant study, laboratory tests and detailed field engineering tests, claim to have produced in their Wissco Lehr Belt a product that is a decided improvement. Their successful development of this belt is said to be the result of long engineering experience, use of the best possible material, highest type of construction, and special fabrication applicable for use in the belt type of lehr. It is stated that practically all of the stretching and shrinking is eliminated before the belt goes to the user. Belts as wide as twelve feet are in successful operation.

"Constitution of Glass" Now Available

"CONSTITUTION OF GLASS," edited by Dr. W. E. S. Turner, Honorary Secretary of the Society of Glass Technology, Sheffield, England, can now be obtained either from the office of the American Ceramic Society, 2525 North High street, Columbus, Ohio, or from F. C. Flint, American Treasurer, Society of Glass Technology, 303 S. Main street, Washington, Pa.

A review of this book appeared on page 197, August, 1927, issue of THE GLASS INDUSTRY.

The Glass World and What It Is Doing

News of the Industry

Conference on Colored Glass Containers

On May 4th a conference was held in New York, attended by members of committees of four national organizations, the American Pharmaceutical Association, the Glass Container Association, the American Drug Manufacturers Association and the American Pharmaceutical Manufacturers Association, to consider the problem of the deterioration of chemicals and pharmaceuticals when stored in glass containers. The conference was presided over by Dr. H. V. Arny.

A motion was passed authorizing the appointment of a committee to sound out the manufacturers of pharmaceuticals and chemicals as to the practicability of raising $2,000 to institute a research fellowship under the supervision of Dr. Arny and of the American Pharmaceutical Association and of Dr. Ayers of the Glass Container Association to study the influence of certain colored glasses on the protection of chemicals and pharmaceuticals.

Chairman Arny appointed as this committee Mr. C. C. Doll of the American Pharmaceutical Manufacturers Association, Dr. F. Dunning of the American Pharmaceutical Association, and Dr. John C. Krantz, Jr., of the American Drug Manufacturers Association.

The representatives of the Glass Container Association offered to the conference all of the research facilities of the association, its laboratories, its physical data and such containers as will be needed to carry on the proposed research.

Glass Bowl Presented to "Bremen" Fliers

A glass bowl, designed especially for the occasion, was presented by the Corinthian Company, manufacturers of gold encrusted and silver deposit glassware, New York, to the "Bremen" fliers, Captain Hermann Koehl, Major James Fitzmaurice, and Baron Guenther von Huenefeld.

The scene depicts the airplane flying above the ocean. In the rear of the plane are the words: "Berlin, Dublin, April 12, 1928." In front of the plane: "Greenly Island, April 13, 1928." Beneath the large figures spelling "Bremen" are the words: "To the Mem-

GOOD-WILL GIFT TO FLYERS

bers of the Crew from the Corinthian Co., N. Y." The bowl is a roll edge flower bowl of pink glass, 14 inches in diameter, made by the Central Glass Works, Wheeling, W. Va.

It has a four inch incrusted border. The lettering is in black enamel. The bowl was decorated by Karl Joerger, fired and finished by Walter Joerger. The paste gold and enamel were furnished by The Roessler & Hasslacher Chemical Company. The glass statue, ten inches in height with gold base, was etched by D. W. Bowen.

The crew of the "Bremen" was composed of two Germans and one Irishman, all being veterans of the World War.

Judge Jennings Resigns

Surprise and regret spread through the glass container industry when the resignation of Judge I. G. Jennings whose activities in the Glass Container Association are well known to all, was announced at the recent meeting of the Association at Atlantic City. Judge Jenning's abilities as an organizer and manager have called him to engage in professional and advisory work. His great talents along this line will be available for both association and business organizations. All those who have had the pleasure of Judge Jenning's friendship or acquaintance hope that his new venture will not take him so far afield that they will be deprived of at least occasional contact with him.

The Great Southwest to Have New Tumbler Factory

In November, 1907—21 years ago—an almost unheard of section of the United States was admitted to the Union under the name of "Oklahoma."

J. B. Greer, the well-known automatic glass machinery man of Pittsburgh, returned recently from an extended visit to Oklahoma, full of enthusiasm for what he had seen and anxious to tell his friends about it. Incidentally, Mr. Greer succeeded in interesting capital in the establishment of a tumbler plant in Oklahoma and is also prepared to arrange the financing of a bottle factory. But that is not the only reason for his optimism—there are others. He says:

The United States Bureau of Mines has furnished some interesting figures regarding the mineral wealth of Oklahoma. The Bureau estimates that the production of petroleum in 1926 was valued at $413,900,000. Natural gas, natural gas gasoline, and zinc each contributed over $40,000,000 worth of products. Lead over $11,000,000. Coal over $9,000,000. Miscellaneous products, including sand, approximately $11,000,000, making a total production of $569,500,000. The agricultural wealth in 1925 was reported at $491,000,000 excluding enormous returns from the stock raising industry.

Glassmaking has already been established as an important industry in the territory where "The Gas Blows and the Oil Flows." Sapulpa, the crystal city, has four large glass industries which provide employment for hundreds of men and women.

Okmulgee, Sand Springs, Briscoe and Ada, are all situated in the glass belt of Oklahoma. The price of fuel ranges from 8 cents per thousand feet to 20 cents, depending on the quantity consumed. Good railroad facilities are said to be a big factor in the development of this territory, and freight rates favorable for meeting competition.

Mr. Greer says Oklahoma enjoys an excellent climate, cheap living conditions and high class social conditions. Other industries flourishing in this state are textile mills, flour mills, and brick manufacturing. Oklahoma City, the capital of the state, has a population of 150,000 boosters, and is proud of her rapid development. Beautiful buildings now stand on corners where less than twenty years ago the medicine man disposed of his tonics and the cow-boy caused the tenderfoot to dance to the tune of his Colt.

Amsler-Morton Company Busy

The Amsler-Morton Company reports ample business to occupy the time of its rapidly expanding organization; work is in progress for various branches of the industry in all parts of the world.

Two Unit tanks and portable lehrs have been placed in successful operation at Southern Glass Company, Los Angeles, California. Four portable lehrs are about completed for Capstan Glass Company, Connellsville, Pa.

One 6'0"x90'0" I. W. lehr is under construction for Heye-Gerresheim, Dusseldorf, Germany. One Amco batch feeder is under construction for Australian Glass Mfg. Company, Ltd., Melbourne, Australia.

A 20 ton 12 ring producer gas fired continuous tank is under construction at McKee Glass Company, Jeannette, Pa. Three small recuperative tanks have recently been completed for the Highland Glass Company, Washington, Pa. One 10x16 Unit Tank has recently been completed for the Hocking Glass Company, Lancaster, Ohio, and a repeat order is now on hand for another slightly larger.

One portable decorating lehr 4'0"x75'0" is to be built for the Alladin Industries, Inc., in their new plant at Alexandria, Indiana.

One 10'0"x80'0" I. W. lehr is to be installed for the Indiana Glass Company, Dunkirk, Indiana, during the first two weeks in July. Repairs were recently made to No. 1 tank for Maryland Glass Corporation and are now under way on the No. 2 tank.

A complete W-S-M automatic gas producer plant is under construction for the Brockway Machine Bottle Company, Brockway, Pa., following the successful installation of three Amco Unit lehrs.

A small continuous Unit tank has recently been completed for Lancaster Lens Company, Lancaster, Ohio. Four Amco Unit lehrs are now in successful operation at Pine Glass Company, Okmulgee, Okla.

The Thatcher Manufacturing Company of Elmira, N. Y., has purchased one Amco batch feeder. One 3'0"x75'0" lehr with Amco Stacker is to be installed for Glenshaw Glass Company, Glenshaw, Pa.

One 6 ton Amco Unit raw producer gas fired tank is now in operation at Indiana Glass Company, Dunkirk, Indiana. This is one of the few, if not the only successful recuperative raw gas fired tanks in the glass industry.

Ambassador Houghton Returns

Alanson B. Houghton, United States Ambassador to the Court of St. James, who is chairman of the board of the Corning Glass Works, sailed for New York May 26. His mission is stated to be of a private nature, connected with the settlement of the estate of his brother, Arthur A. Houghton, who died in April, and who had been active until shortly before his death in the management of the Corning Glass Works.

Eastern Division Meeting Postponed

Notice has been sent to all members of the National Glass Distributors Association by President A. D. Dwelle, that owing to the date set for the regular meeting of the Window Glass Manufacturers Association in Chicago on Wednesday, May 23, and because a conference had been requested with the Window Glass Committee of the National Glass Distributors Association on Tuesday morning, May 22, to take up the subject of qualified buyers and other important details, it was found necessary to change the date of the Eastern Division Meeting in New York from May 22 and 23 to Tuesday and Wednesday, June 5 and 6. No May meeting therefore was held in New York as obviously the members could not attend meetings in both cities at the same time.

Spring Meeting of Glass Container Association

At the annual meeting of the Glass Container Association held at the Hotel Traymore, Atlantic City, on April 26 and 27, the following officers were elected:

President—P. I. Heuisler, Maryland Glass Corporation, Baltimore, Md.

1st Vice-President—W. H. McClure, Hazel-Atlas Glass Company, Wheeling, W. Va.

2nd Vice-President—H. C. Mandeville, Thatcher Mfg. Company, Elmira, N. Y.

Secretary-Treasurer—R. E. Walker, Turner Glass Company, Terre Haute, Ind.

Over 100 members were present at the meetings.

April Production of Plate Glass

Figures compiled by the Plate Glass Manufacturers of America, P. A. Hughes, secretary, show the production of polished plate glass for the month of April, 1928, was 9,953,474 square feet, as compared with 11,297,173 square feet produced in March. The production for April, 1927, was 10,299,476 square feet.

April Construction Broke All Records

April construction contracts in the territory east of the Rocky Mountains broke all previous monthly records, according to F. W. Dodge Corporation. Building and engineering work contracted for last month in the 37 Eastern States (about 91% of the total country) amounted to $643,137,100.

Chapman-Stein Obtains Full Control

The Champan-Stein Company, Mount Vernon, O., of which B. B. Williams is president, is informing the trade that a few months ago the Chapman Engineering Company, which already owned half of the stock of the Furnace Company, purchased the remaining 50% from the Stein Company of Paris. With the two companies unified as to ownership and working in the same field of engineering, it was most logical to merge their operations and give the trade the advantages of the better service and economies possible with a larger organization. The personnel of the two companies has all been retained and the executive offices remain practically the same. The enlarged company will continue to broaden its service in the field of combustion engineering. Special attention will be given to the sale of gas producers, industrial furnaces and all allied equipment including the construction of complete producer gas plants.

Trade Activities

The Doerr Glass Company, Vineland, N. J., suffered from a fire May 4, said to have caused a loss of several thousands of dollars.

A. J. Ritter Company, 163 Highland Avenue, Newark, N. J., has been incorporated with a capital of $100,000 to deal in glassware.

Thomas S. Tate, formerly a chemist for the United States Glass Company, Pittsburgh, is now chief chemist for the Hocking Glass Company, Lancaster, O.

The Coshocton Glass Corporation's plant, Coshocton, O., was sold on May 12 subject to confirmation by the court to Harry Neff of Bellaire, Ohio, for $15,000.

Pennsylvania Bottle Company, Sheffield, Pa., of which R. R. Underwood is president and general manager, is almost ready to put their remodelled factory into operation.

Standard Plate Glass Company reports for quarter ended March 31, 1928, net loss of $229,921 after depreciation, interest, etc., against net loss of $192,400 in first quarter of 1927.

Wm. J. Serrill, assistant general manager of the United Gas Improvement Company of Philadelphia, has been elected chairman of the American Engineering Standards Committee.

The Louie Glass Company, Louie Wohinc, president, advise that they have acquired the Weston Glass Company's plant at Weston, W. Va., to which an addition 75x150 feet in size is almost completed.

Joseph Norwood Company, Columbus, S. C., manufacturers of mirrors, are reported to have interested capital which will be used for the consolidation of Lenoir Mirror Company and Jonas Furniture Company.

The Lovell Glass Company, Lovell, Wyo., whose plant was destroyed by fire late in April have reported that it will be rebuilt. This was one of the few plants in the country still making hand blown window glass.

The National Peanut Butter Manufacturers Association which stands for "better peanut butter" will hold its annual annual convention June 6 and 7 at the Hotel Stevens, Chicago. Manufacturers of glass containers may be interested in this item of news.

The Brilliant Glass Sales Company, Weston, W. Va., is reported to have been incorporated with a capital of $25,000. The incorporators are given as M. D. Sprigg, Thomas A. Edwards, Andrew Edmiston, Jr., J. H. Brewster, and Charles M. Snaith, all of Weston.

The Superior Glass and Mirror Company, Indianapolis, Ind., has been incorporated with a capital of $25,000, to manufacture glass products. The incorporators are G. R. Vandenbosch, E. W. Turner, R. E. Graham, Ralph M. Nash and C. H. Wills, all of Kokomo, Indianapolis.

The Hazel-Atlas Glass Company's quarterly report for the three months ending March 31, 1928, shows a net gain for the three months period of $402,130. The total income after deducting for repairs and maintenance of $231,161 showed a balance of $853,198. Deductions of taxes, general depreciation, reserves and interest on borrowed money, leave the net sum mentioned above.

Consolidated Mirror Company, High Point, N. C., is reported to be issuing 2,000 shares of capital stock without par value, for the purpose of manufacturing, buying and selling

glass and glassware. The following are stated as being interested: A. M. Rankin, Jr., A. W. Rankin, Sid P. Childress.

General Flat Glass Company, Mannington, W. Va., held a general meeting for stockholders on May 14, at which a committee is said to have been appointed consisting of F. A. Burt, I. W. Davis, Walter Jenks, H. Val Burt and S. F. Clutter, for the purpose of formulating new plans for reorganizing and financing the company.

Professor Alexander Silverman, Head of the Department of Chemistry of the University of Pittsburgh, sailed May 18 for a three months' tour of Europe. During the first month, Professor Silverman will be with the American Ceramic Society on its European Tour. The remainder of the time will be spent in countries not covered by the tour. He will visit educational institutions, museums, and glass factories in France, Switzerland, Italy, Austria, Germany, Czecho-Slovakia, Belgium, the Netherlands, England, and Scotland. He expects to acquire numerous glass specimens for the collection at the University.

The Weston Glass Company, Weston, W. Va., has, it is reported in *The Weston Democrat,* denied that the company has been purchased by the Louie Glass Company and state that it is not controlled by them, as was published in certain local papers. An official statement was issued to the effect that the Weston Glass Company is an independent corporation with different management from the Louie Glass Company and has the following officers who were elected to the board of directors on Jan. 28, 1928: Louie Wohinc, president and general sales manager; John Weber, vice president; E. Hager, general manager; Ray Lorentz, treasurer; Max Adolt, secretary, and G. Weber, attorney-in-fact. All the above mentioned officers are said to be stockholders of the Weston Glass Company.

Wm. G. Bergman, of Toledo, O., has issued an open letter to the glass industry calling attention to the fact that he has severed his connection with the Toledo Engineering Company and that he is now prepared to serve the industry personally on an efficient basis. Mr. Bergman calls attention to his long years of engineering and practical experience in the operation and construction of glasshouse equipment, developing original ideas for manufacturing methods and in locating and remedying glassmakers' troubles. He will undertake the design of complete plants including furnaces, lehrs, reconstruction work, engineering supervision and will accept construction contracts on new or repair work. His experience in the glass industry has extended for more than 25 years and his letter includes a statement in regard to his policies, covering ten points which he considers essential for success in handling glass house construction problems, etc. Mr. Bergman's address is 2252 Rosewood Avenue, Toledo, O.

Industrial Publications

Electric Equipment for Plate Glass Plants. A 4-page bulletin describing equipment for plate glass plants especially designed by the General Electric Company which is supplied for every operation in plate glass making from batch mixers to polishing tables. The company considers as their greatest contribution to this field the perfection of equipment to drive the huge grinding and polishing tables. Synchronous motors, induction and direct current motors, are illustrated and described, and also control equipment.

Centrifugal Air Compressors, Single Stage. Bulletin describing General Electric Company Centrifugal Air Compressors, Single Stage. Applications and construction details are given. These machines are successfully applied to various uses in glass factories.

Electric Equipment for the Bottle Glass Plants. A 4-page bulletin describing General Electric equipment for bottle plants, which is designed to cover every operation in the bottle, container and tableware industries.

Recent Deaths

Elmer E. Myers

Elmer E. Myers, one of the founders of the Pennsylvania Window Glass plant at Kane, Pa., now out of existence, died in Brookville, Pa., on April 22.

S. Earl Clark

S. Earl Clark, superintendent of the Pittsburgh Plate Glass Company at Ellwood, Indiana, and a prominent citizen of that city, died at his home on May 15th of heart trouble.

H. G. Carrell

H. G. Carrell, general manager of the Solvay Sales Corporation, New York, died suddenly on shipboard May 18, from a heart attack, while en route from New York to Virginia. Mr. Carrell had been connected with the Solvay Process Company for many years prior to the organization of the Solvay Sales Corporation. He was widely known throughout the glass manufacturing trade and his passing has been the cause of great regret on the part of his friends and acquaintances.

Coming Meetings

The National Lighting Equipment Exhibition of the Artistic Lighting Equipment Association will be held at the Hotel Sherman, Chicago, Ill., June 11 to 16.

The Stained Glass Association of America will hold its annual meeting June 25th to 27th at the Edgewater Beach Hotel, Chicago, Ill.

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

South Africa: 30,866, Glass, cut in new designs.
Australia: 30,912, Glass tubing (lead), for gas signs.
Canada: 30,872, Glass tumblers, jam jars, and bottles, all sizes.
Italy: 30,906, Glassware, toilet.
Italy: 30,906, Bottles, vacuum.
Japan: 30,967, Glass, plate, shaped for sugar tanks.
Germany: 31,315, Faceting machinery, oval glass and flasks.
Venezuela: 31,331, Eye-glasses and charts.
England: 31,219, Glass for making pharmacy jars, food containers, etc.
Germany: 31,154, Glass rolls.

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE, MAY 26, 1928
Reported by Moore, Leonard & Lynch, Union Trust Bldg., Pittsburgh, Pa.

	Bid	Asked	Last
American Window Glass Machine, Com...	..	24	22
American Window Glass Machine, Pfd...	30	42	42
American Window Glass, Pfd.....	87	90½	88½
United States Glass.....	13¼	14	14
Pittsburgh Plate Glass, Com.....	..	..	225
Standard Plate Glass, Com.....	..	..	4⅛
Standard Plate Glass:			
Preferred cumulative.....	..	..	18⅞
Prior preferred.....	..	..	32

TOLEDO, O., MAY 25, 1928

	Bid	Asked	Last
Owens Bottle, Pfd.....	115	..	115
Libbey-Owens Sheet Glass, Com.....	132	135	130
Libbey-Owens Sheet Glass, Pfd.....	115	117	116

WHEELING STOCK EXCHANGE, MAY 25, 1928

	Bid	Asked	Last
Hazel-Atlas	89½	90½	90½
Imperial	..	..	72
Fostoria	..	..	208
Central	..	..	75
Jefferson, Pfd.....	..	..	96

READERS WANTS AND OFFERS

For Sale: CULLET of all Descriptions
Free from Caps, Wires, etc.
GEORGE F. BAUMANN, Dealer,
1110 Carroll Street, Brooklyn, New York.
Carloads Ready for Immediate Shipment.

WANTED, BACK NUMBER of THE GLASS INDUSTRY, January, 1923. Premium offered. Address, 50 Church St., New York.

Current Prices of Glass-Making Materials

May 24, 1928

Quotations furnished by various producers, manufacturers and dealers

		Carlots	Less Carlots
Acid			
Citric (dom.)	lb.	.46	.46
Hydrochloric (HCl) 20° tanks, per 100 lb.		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	.38	.38-.39½
Alcohol, denatured	gal.	..	.53
Aluminum hydrate ($Al(OH)_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.21
Ammonia water (NH_4OH) 26° drums	lb.	.03	.03¼
Antimony, metallic (Sb)	lb.	..	.10⅞-.11
Antimony oxide (Sb_2O_3)	lb.	..	.14
Antimony sulphide (Sb_2S_3)	lb.	..	.13
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.04¼-.04½
Barium carbonate ($BaCO_3$)			
Precipitated	ton	57.50	60.00
Natural, powdered, imported	ton	45.00	50.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08¼	.08½
Barium selenite ($BaSeO_3$)	lb.	..	..
Bone ash	lb.	.05	.05½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.03¾	.04-.04½
Boric acid (H_3BO_3)	lb.	.08-.08¼	.08¼-.08¾
Refined	lb.	.08-.08¼	.08½-.08¾
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	1.10-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.27	.28
Cobalt oxide (Co_3O_4)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	.	.30
Cryolite ($Na_3Al F_6$) Natural Greenland Kryolith)	lb.	.09	.10-.10½
Artificial or Chemical	lb.		.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.30
Feldspar—			
100 mesh	ton	13.00-20.00	15.50-22.00
80 mesh	ton	11.75	14.50
40 mesh	ton	11.00	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	.08	.08½
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.03¼-.07
Black (FeO)	lb.	.03½	..
Kaolin (f.o.b. mine)	ton	9.00	..
English, lump, f.o.b. New York	ton	14.50	24.50
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	.08¾-.09½	.09½-.09¾
Litharge (PbO)	lb.	.07⅞-.08½	.08½-.08¾
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	11.50-12.50	..
Burnt (CaO) ground, in bulk	ton	8.00	..
Burnt, ground, in paper sacks	ton	10.00-11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15	2.30
Limestone ($CaCO_3$)		2.00	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.08
Manganese 85% (MnO_2)	lb.	.04	.04½
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	23.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08½	.09
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	06⅝	.07½
Hydrated 80-85%	lb.	.06	.06½
Potassium chromate (K_2CrO_4)	lb.	..	.28
Potassium hydrate (KOH) (caustic potash)	lb.	.07⅛	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.05⅞-.06
Potassium permanganate ($KMnO_4$)	lb.	.14½	.15
Powdered blue	lb.	..	.24-.26
Rochelle salts, bbls.	lb.	..	.23
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	1.95-2.00
Silver nitrate ($AgNO_3$)	oz.	..	.43½-.45½
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½	..
In barrels	Per 100 lb.	1.55-1.57½	2.40
In bags	Per 100 lb.	1.37½-1.40	..
Spot orders..02½-.05 per 100 lbs. higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07¼
Sodium hydrate (NaOH) (caustic soda)	Per 100 lb.	3.35	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04½
95 per cent.	Per 100 lb.	2.32½	2.75
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.04½	.05
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.25
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.38½	..
Tin oxide (SnO_2) in bbls.	lb.	..	.56
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb.	..	1.25-2.25
Zinc oxide (ZnO)	lb.	.06½-.08½	.12
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to April 24, 1928

	March 1927 Quantity	March 1927 Value	March 1928 Quantity	March 1928 Value	Three Months Ending March 1927 Quantity	Three Months Ending March 1927 Value	Three Months Ending March 1928 Quantity	Three Months Ending March 1928 Value
Glass and glass products (total)	.....	$802,105	.....	$843,692	.....	$2,125,779	.....	$2,277,698
Plate and window glass—								
Window glass, common, box 50 sq. ft.	864	6,490	1,972	12,304	3,871	25,060	4,239	27,497
Plate glass, unsilvered, sq. ft.	111,331	29,652	203,583	78,126	357,214	93,341	433,983	163,848
Other window and plate glass lbs.	372,352	28,468	232,604	34,099	1,013,963	83,648	857,286	113,063
Glass containers (bottles, vials and jars)	.....	288,827	.....	261,865	.....	676,132	.....	751,002
Table glassware, plain	.....	153,258	.....	116,654	.....	374,229	.....	320,639
Table and other glassware, cut or engraved	.....	9,888	.....	11,398	.....	30,042	.....	29,604
Lamp chimneys and lantern globes lbs.	154,184	32,439	133,768	30,784	547,525	115,437	487,723	99,916
Globes and shades for lighting fixtures lbs.	126,528	53,301	147,104	53,891	409,770	155,762	389,748	143,252
Chemical glassware lbs.	12,534	11,244	14,183	13,077	37,153	35,287	48,798	42,214
Electrical glassware, except for lighting lbs.	226,369	16,839	323,145	21,369	654,494	65,063	1,231,255	92,287
Other glassware	.....	171,699	.....	210,125	.....	471,778	.....	494,376

IMPORTS

Corrected to April 24, 1928

Glass and glass products	.....	$1,507,561	.....	$1,193,151	.....	$4,164,401	.....	$3,225,633
Cylinder, crown and sheet—								
Unpolished—								
Weighing less than 80 pounds per case dut. lb.	4,295,734	116,208	3,589,931	92,752	12,080,277	323,171	8,946,035	256,263
Weighing 80 pounds or over per case dut. lb.	3,788,364	148,466	3,566,621	132,952	10,765,857	517,060	8,252,739	366,025
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	39,923	.....	32,190	.....	112,327	.....	106,215
Plate glass—								
Polished, unsilvered dut. sq. ft.	1,740,084	512,745	1,535,968	335,479	4,128,136	1,375,147	3,619,745	783,277
Other dut. sq. ft.	85,792	24,077	77,275	19,853	265,061	68,180	279,262	66,491
Bottles, vials, jars, demijohns and carboys, molded or pressed dut.	.....	17,872	.....	15,308	.....	55,474	.....	58,559
Table and kitchen utensils dut.	.....	7,436	.....	31,345	.....	32,742	.....	60,532
Glassware, cut or decorated dut.	.....	301,149	.....	209,755	.....	795,541	.....	586,405
Blown glassware, n. e. s.—								
Bottles, ornaments, gauge glasses and other n. e. s. dut.	.....	61,909	.....	69,370	.....	176,136	.....	197,481
Bulbs for electric lamps dut. No.	1,600,775	15,922	1,072,315	12,199	4,188,111	40,767	3,341,156	35,299
Chimneys, globes, shades, prisms and other illuminating glassware dut.	.....	69,050	.....	83,016	.....	213,393	.....	214,515
Articles and utensils for chemical, scientific, and experimental purposes dut.	.....	46,198	.....	41,224	.....	120,041	.....	128,464
Other glassware dut.	.....	146,606	.....	117,708	.....	334,422	.....	366,107